DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

MAY, 1943

June MACHINERY will continue to discuss important aspects of the manufacture of war materials. The leading article will deal with the manufacture of gun mounts, and another with small-arms ammunition. Also of direct application to the war effort is an article on aiding war work by rebuilding machine tools. An article applicable to the aircraft industry will describe special devices for airplane production. The third and last article in a series on direct-current drives for machine tools will be of especial interest to the machine designer.

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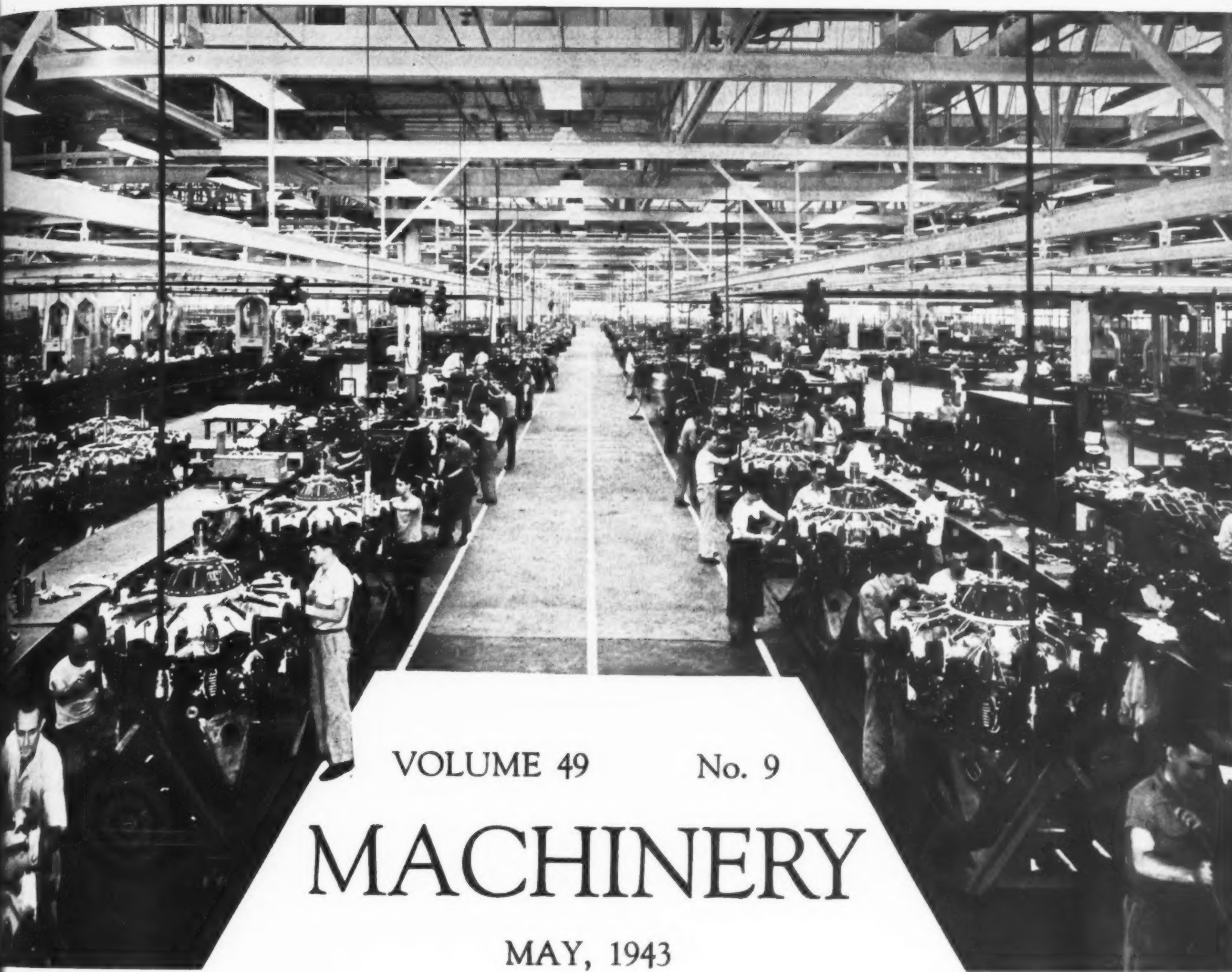


VOLUME 49 No. 9

MACHINERY

MAY, 1943

Grinding Steel Crankcases for Aircraft Engines

How Steel Crankcases Developed for Wright Radial Type Aircraft Engines are Economically Machined to Close Tolerances on Bryant Internal Chucking Grinders

By P. C. DURLAND
Bryant Chucking Grinder Co.
Springfield, Vt.

THE development of steel crankcases by the Wright Aeronautical Corporation for use in radial type aircraft engines introduced the problem of economically producing a fine finish to close tolerances on internal surfaces difficult to machine by conventional methods. The steel crankcases were designed to reduce weight to the absolute minimum, and yet retain sufficient strength to withstand the stresses developed by the tremendous concentration of power produced by the assembled engine. Consequently, from the standpoint of weight reduc-

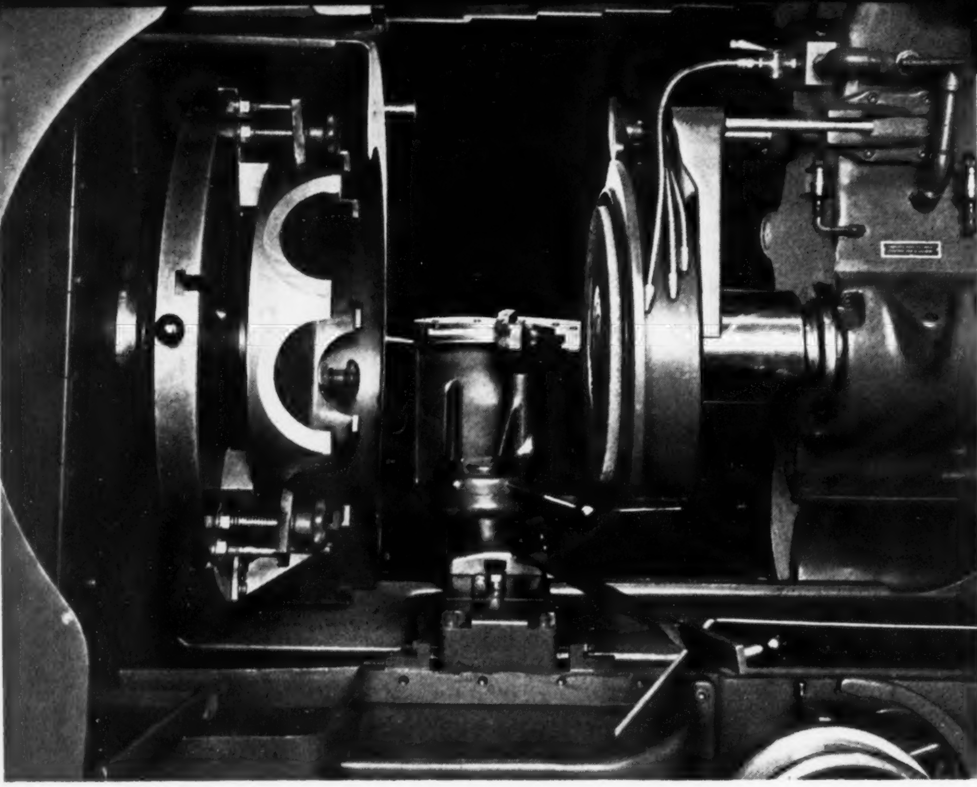


Fig. 1. Typical Bryant Chucking Grinder Set-up with Special Wheel Dresser, Used in Finish-grinding Operations on Inner Surfaces of Wright Aircraft Engine Crankcases

tion, all cross-sections of the crankcase walls, webs, flanges, and hubs must be extremely thin.

To insure the necessary strength, however, the size, shape, and thickness of these sections must be accurately controlled. Further, in order to detect any flaws in the finished pieces, a Magnaflux test is generally applied, which, in order to give reliable results, requires that the surfaces of the parts examined must be quite smooth. A smooth surface is also desirable in order to reduce the danger of fatigue cracks.

Until recently, the common method of meeting requirements in finishing the inside surfaces of the steel crankcases was to finish-turn or mill to within close limits, and then polish by hand or other means to obtain the fine finish demanded. In most cases, this final polishing operation proved far too costly. About three years ago, the problem of developing a more economical method of finishing the crankcases was taken up by the Bryant Chucking Grinder Co., following which a machine was built and installed at the Wright plant to determine whether internal grinding offered any advantages over the polishing method of finishing.

Truing the grinding wheels to the required shape at first presented some difficulties, but a wheel dresser was finally developed that solved this problem satisfactorily. Actual production eventually proved this method of finishing the

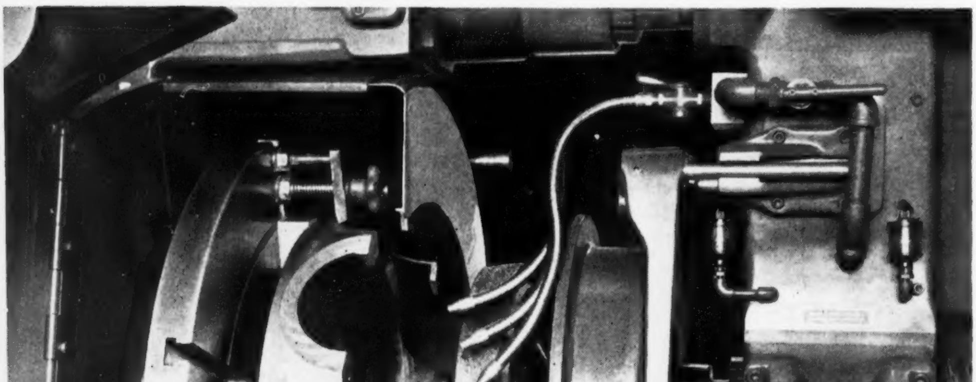


Fig. 2. Set-up of Grinder Shown in Fig. 1 with Guard Retracted and Wheel Dressed to Form Required for Precision-grinding of a Portion of the Inner Surface of Crankcase

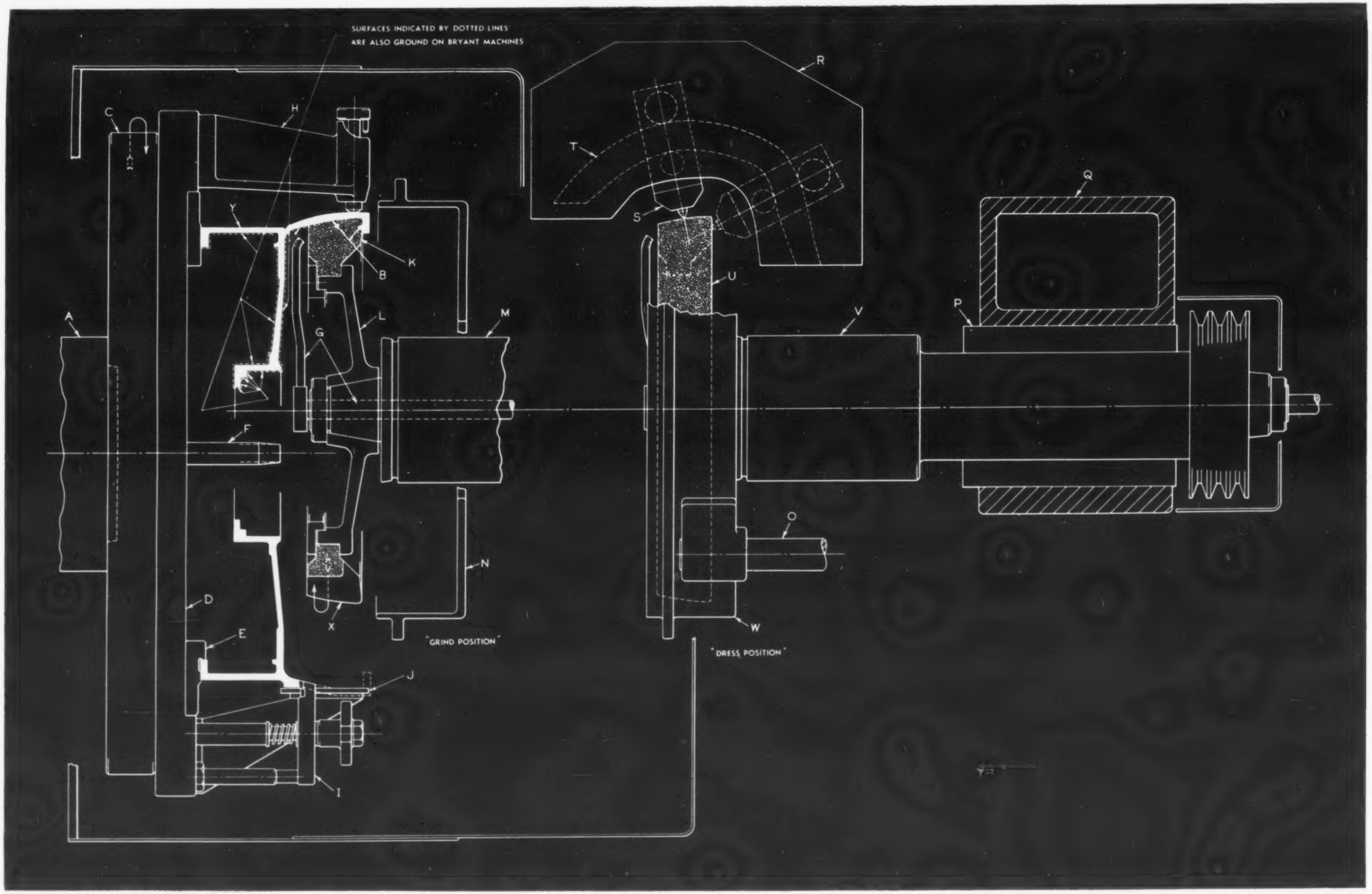


Fig. 3. Steel Crankcase Section Y of Wright Radial Aircraft Engine Held in Special Fixture for Finishing Surfaces B

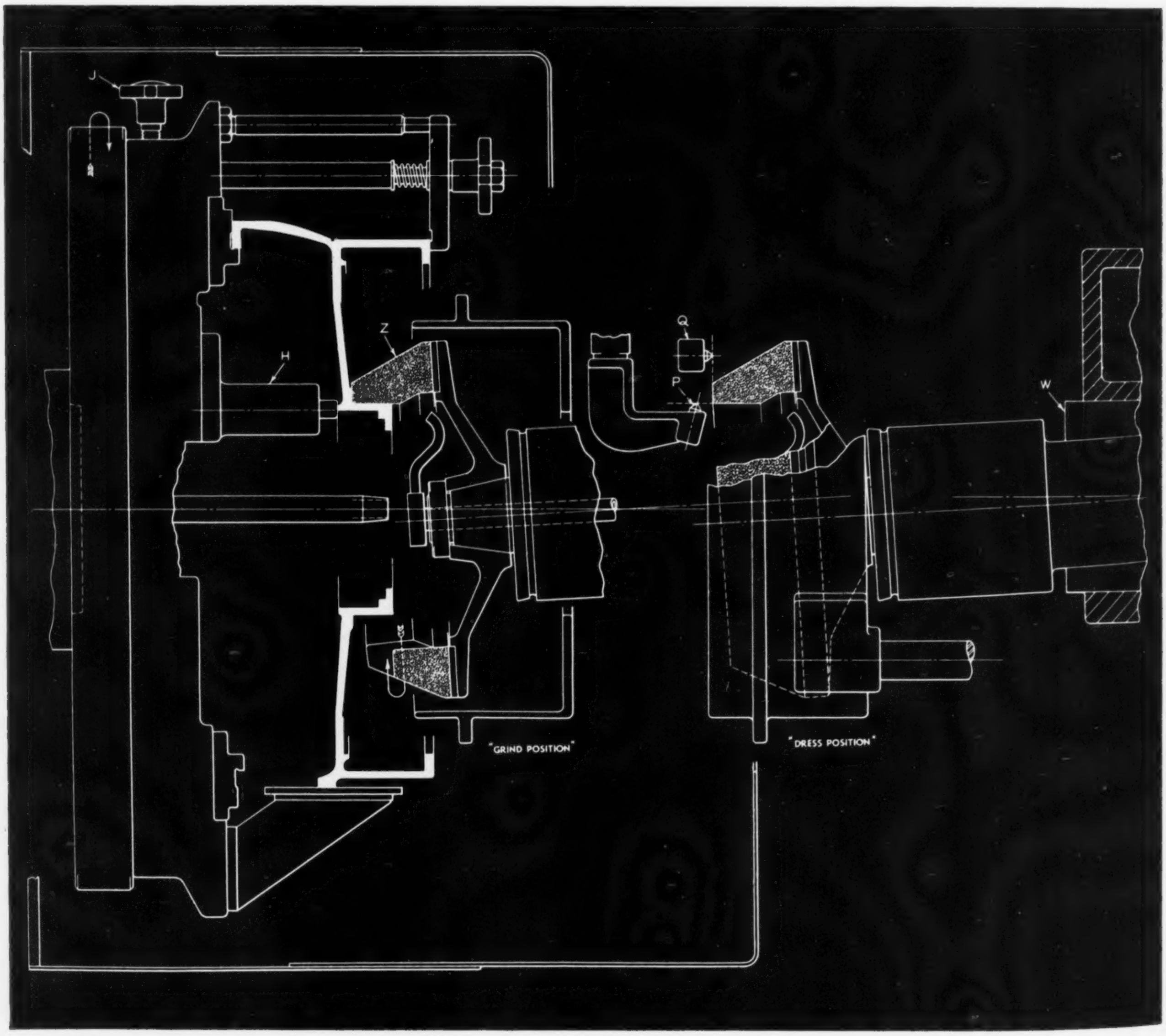
inside surfaces of steel crankcases to be satisfactory, as well as economical. Internal grinding machines of this type have been built by the Bryant company in increasing numbers ever since the first one was installed at the Wright plant, and many more of the same general type for finishing crankcases of various sizes and shapes are scheduled for production.

Special Methods and Equipment Employed

The machines built for the crankcase-finishing operations differ from the usual Bryant internal grinder in several respects, and they employ special grinding wheels designed for each individual job. The wheels range from 12 to 20 inches in diameter, and their shapes and the methods of grinding vary in each case. These wheels are also of a special grade and grain. Because of the large size of the grinding wheels and the heavy cuts they must take and yet produce a fine finish on the surfaces of the work, it is necessary to provide a much heavier wheel-head than is required on regular machines.

A powerful wheel-drive arrangement, with larger motors and more driving belts than ordinarily used, is required. Because of the added weight on the machine wheel-slide, more rigid machine parts and more room for belts are also necessary. A suitable wheel guard must be provided, as shown in Fig. 1, which is capable of protecting the operator in case of wheel breakage. This guard cannot, of course, be stationary, since there is no room for it when the wheel is

Fig. 4. Special Fixture and Grinding Wheel Z Used to Finish Outside Surfaces of Hub on Steel Crankcase Section



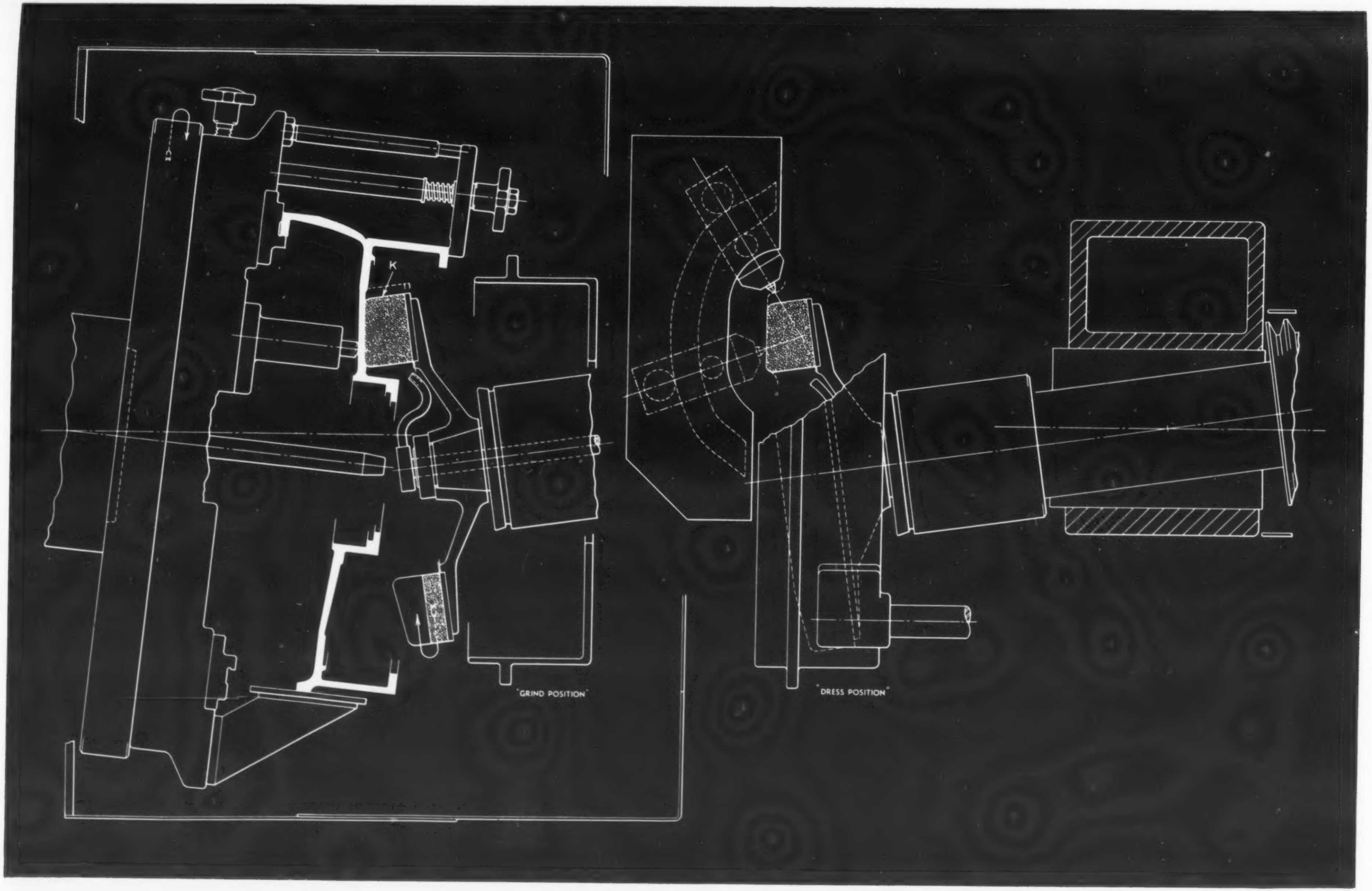


Fig. 5. Special Fixture and Wheel-dressing Equipment Used for Finishing Angular Web Face of Steel Crankcase Section

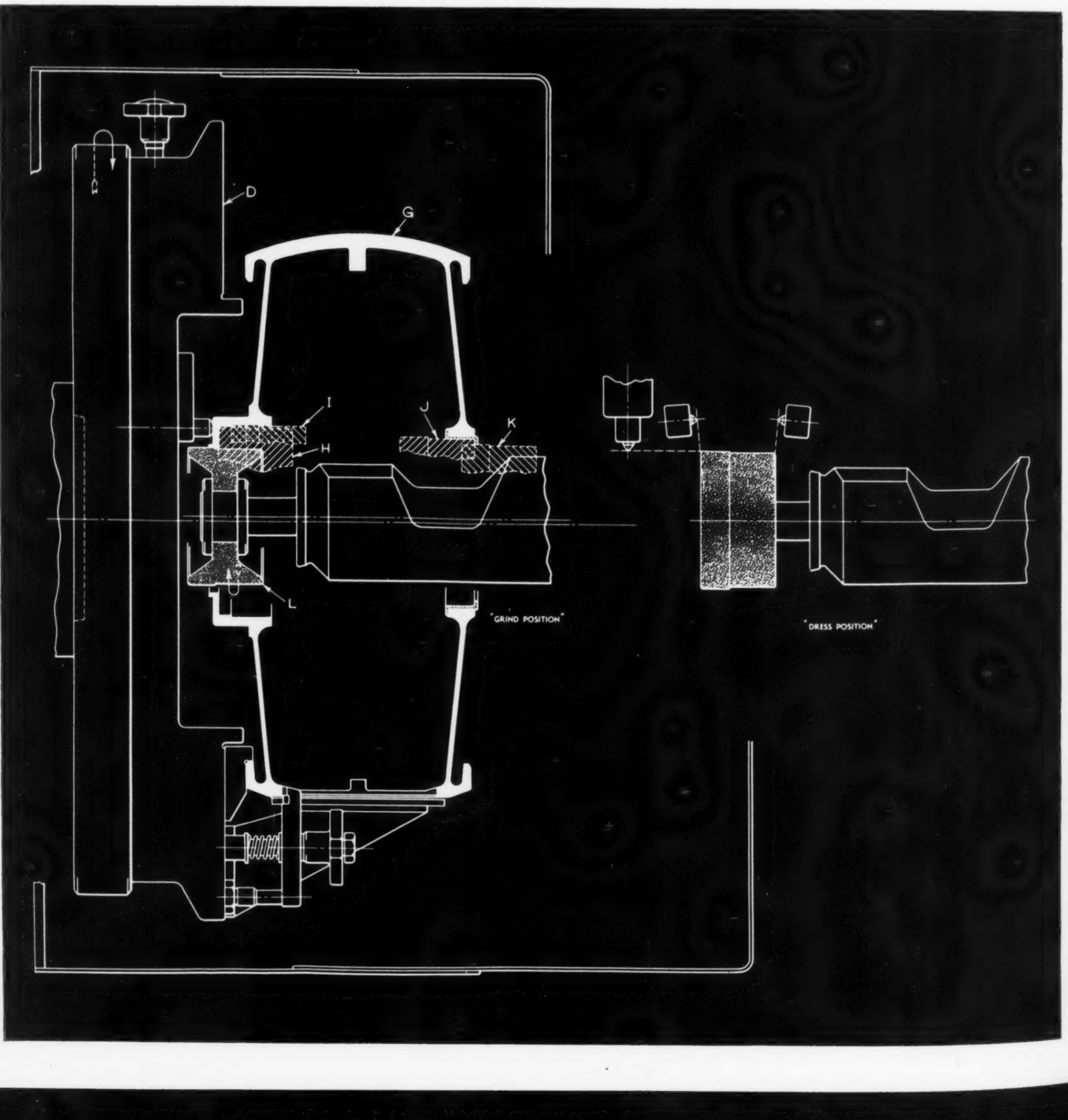
in the grinding position inside the work. Accordingly, a sliding arrangement is used, so that the wheel guard can be moved back out of the way during the grinding operations, as shown in Fig. 2.

Fig. 1 shows the wheel dresser in its operating position. The grinding wheel, however, has been moved to the right of the dressing position to show the dresser to better advantage. The heavily constructed wheel guard is supported on two overhead bars, arranged so that the guard can be pushed back from its position over the grinding wheel when the wheel is moved into the grinding position. The flexible coolant nozzles can be adjusted to direct the coolant wherever necessary.

Another view of the machine seen in Fig. 1 is shown in Fig. 2. In this case, the wheel dresser has been removed from its dressing position and the grinding wheel is shown nearing its grinding position. In order to better illustrate the grinding wheel, the guard has been moved back from its normal position over the wheel.

Because of the large area of contact between wheel and work, there is danger of burning the work. Further, chips of metal from the work

Fig. 6. Steel Crankcase G for Radial Type Engine, Held in Special Fixture D for Finish-grinding Center Bores and Bearing Retainers, Using Wheel in Grinding Positions Indicated at H, I, J, K, and L



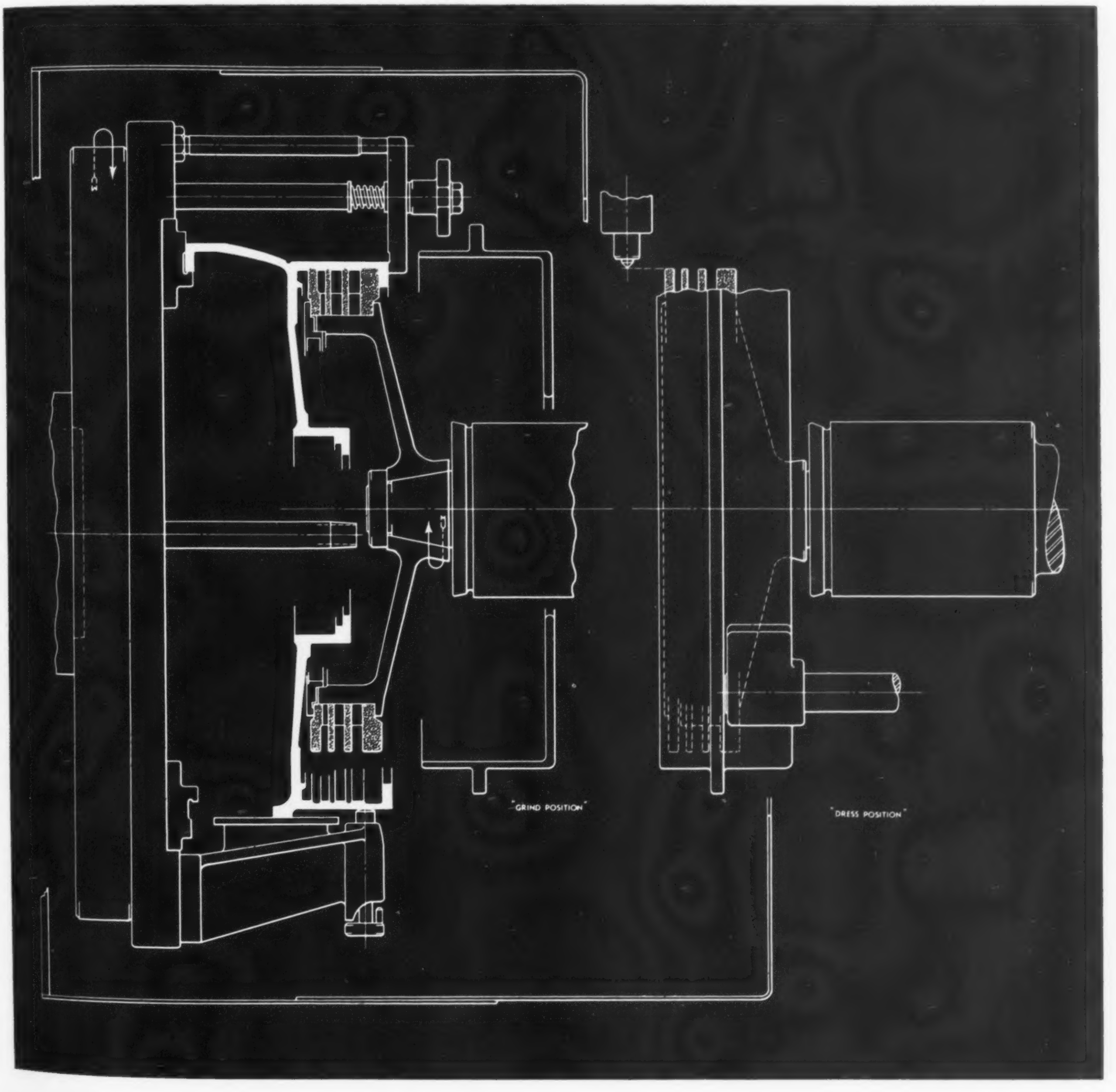
and particles of grit from the grinding wheel tend to score the work surfaces. To prevent these conditions, provision is made for supplying extra large quantities of coolant to the proper places during the grinding operation. The increased quantity of coolant used necessitates more extensive guards to prevent the coolant from escaping.

Owing to the large diameters being ground, a much slower work speed than is ordinarily used for internal grinding is required. This necessitates the use of slower speed gearmotors and different belt and pulley arrangements for the work-spindle drive. Special work-holding fixtures are used, in which supports are incorporated to prevent the work from becoming distorted. Also, various devices are provided to make the operation of the machine as safe as possible for the operator.

Some machines have to be equipped with a hydraulic cross-slide mechanism for the purpose of traversing the grinding wheel transversely across the face of the surface to be ground. Precision stops are necessary to accurately position the grinding wheel in relation to the work. Because of the type of operations

Fig. 7. Set-up of Internal Grinder Employed for Grinding Four Grooves in a Steel Crankcase Section for a Wright Radial Type Engine

VICTORY



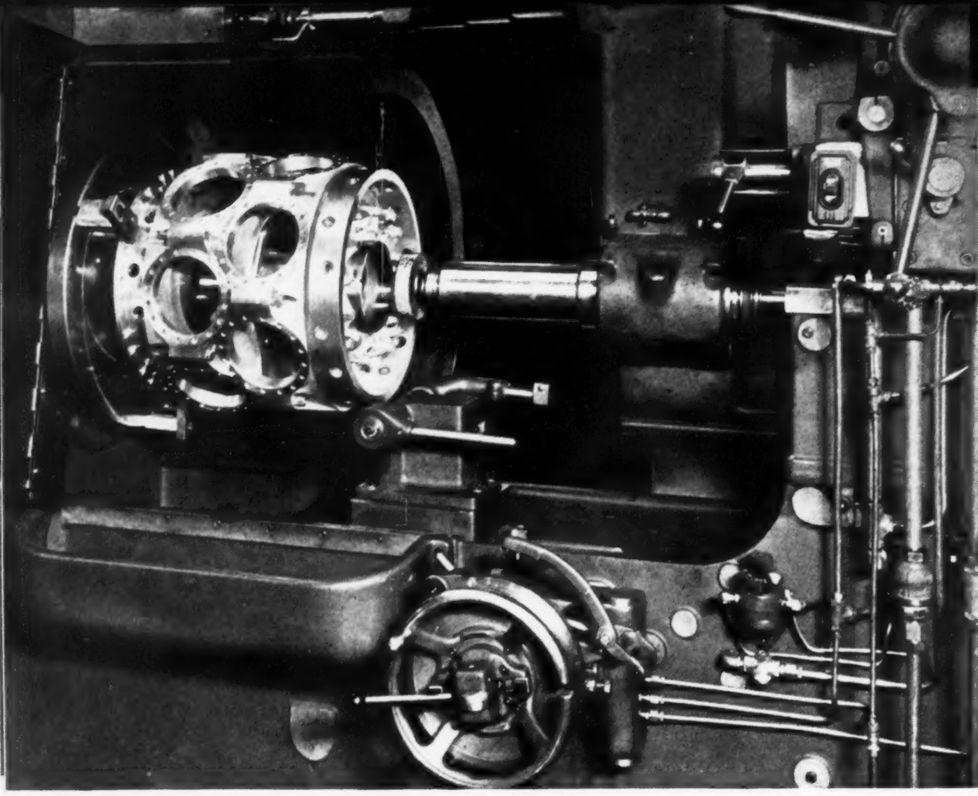


Fig. 8. Internal Grinder with Telescoping Cross-feed Screw and a Special Diamond-holder for Dressing Wheel Used in Grinding Bearing Retainers in Aluminum Crankcase

being performed, these end-stops are entirely different from those ordinarily used.

In some cases, on account of the odd shapes of the grinding wheels, specially designed wheel dressers are required. These dressers are necessarily of such a large size that, if left in their working position, they would interfere with the normal grinding operation. Hence, a flexible supporting arrangement consisting of swinging arms is furnished, as shown in Figs. 1 and 2, which allows the operator to push the wheel dresser back out of the way when it is not in use. Provision is also made for accurately positioning the wheel dresser while it is in place on the table.

Equipment Used for Operations on Crankcases for Double-Bank Radial Type Engines

Fig. 3 shows the arrangement of a Bryant 24-JW-36 internal grinder for grinding the back face of the legs and part of the inside contour *B* of one section of a steel crankcase for a Wright double-bank radial engine. A faceplate *C* is mounted on work-spindle *A*, and to this faceplate is attached the base of a work-holding fixture *D*. Hardened steel locating ring *E* is precision-ground to provide a flat clamping surface for the work and a locating surface for centering the work in the fixture. This centering or locating surface is approximately 0.015 inch smaller in diameter than the diameter of the work. Thus, the machine operator, after loading the work into the fixture, can apply an indicating gage to the work on some previously ground diameter; and, in order to make the work run dead true, he can shift it slightly before clamping it tightly and proceeding with the grinding operation.

Suitable clamps *I* are provided, the number of

Fig. 9. Crankcase with One End Section Removed to Facilitate Grinding Hole for Bearing Retainer in Center Section

clamping units depending on the operation. In this case, there are seven points on the work where clamps could be applied, as shown. A bracket J, with a fiber pad, is furnished for the operator's convenience in loading the work into the fixture. Radial supports H are equipped with spring-actuated plungers, which can be drawn back out of the way while the work is being loaded into the fixture. They can then be released so that they bear against the legs of the work, in which position they can be tightly clamped to prevent the legs from springing during the grinding process. Seven supports are furnished in this particular case, since there are seven legs on this piece of work.

The wheel-head, shown at M and V, is provided with heavy-duty super-precision ball bearings, preloaded to the proper amount for long life and severe usage. The spindle of this wheel-head has a taper nose on which a flange L is mounted for holding the grinding wheel. The grinding wheel, shown at K and U, is clamped to this flange, and is of special design. Grooves at X provide a recess into which grinding-wheel particles can escape as the wheel passes the grinding point on the work. These grooves also permit the coolant to reach the entire line of grinding contact, thus reducing the tendency of the wheel to burn the work. The wheels are run at a speed of approximately 4700 surface feet per minute, which has been found satisfactory for the majority of jobs of this kind.

Work speeds vary from 20 to 100 R.P.M., depending on the particular operation. In this case, a work speed of from 50 to 60 R.P.M. is used, although it is sometimes advantageous to use a slower speed, say around 40 R.P.M., for roughing or removing stock, and then speed up the work to 60 R.P.M. for the final finishing.

Coolant is supplied by pipe F through the center of the work-spindle and by pipe G through the center of the wheel-head. The supply through pipe F, being large in quantity and directed to no particular point, serves mainly to keep the part cool and to wash away grinding-wheel particles. Pipe G is arranged with a distributor to which flexible tubes are attached. These tubes direct the coolant to the actual point of grinding contact, and thus assist in keeping the work cool at this point, help to prevent burning of the work, and also serve to wash the grinding-wheel particles out of the way as the wheel wears or breaks down.

The grinding-wheel guard, shown at N and W, is carried on two bars directly over the wheel and wheel-head, one of which is shown at O. For any position of the grinding wheel, except the actual grinding position, there is a spring that keeps this guard so located that it completely covers the grinding wheel. As the wheel is advanced into the grinding position, this guard is brought up against a stop-bar, which forces it back and away from the wheel. As soon as the grinding operation is finished and the wheel is removed from the work, the guard automatically returns to its position over the grinding wheel through the action of a spring.

The arrangement for dressing the wheel to the required contour is shown at R. This consists of a sliding head S, carried on a pivoted member in such a way that a positive-acting roll on sliding head S when kept in contact with form plate T, will cause the diamond mounted in the head to dress the wheel correctly. Obviously, the form plate T must be designed for each individual job. The slide box Q that carries the wheel-head, grinding wheel, wheel guard, and motor for driving the grinding wheel is of the regular Bryant overhead-slide construction, as shown in the illustrations.

The machine cycle, in performing the operation illustrated in Fig. 3, is as follows: The op-

Fig. 10. View of Set-up for Grinding Crankcase Bearing Retainer Illustrated in Fig. 9, Taken from a Different Angle

erator brings the grinding wheel to the dressing position shown, and proceeds to true the grinding wheel, removing a slight amount of stock from the wheel at each pass of the diamond. After the wheel has been properly trued, the whole wheel-dressing attachment is swung out of position and the grinding wheel is brought into the grinding position.

In this particular operation, the machine is equipped with a hydraulic cross-slide mechanism to allow the wheel to pass into its working position without interfering with the lips on the front of the work. The cross-slide mechanism is then brought into action to swing the grinding wheel outward and in back of the lips on the work, so it will be in the final grinding position shown in the view to the left.

The machine is equipped with a feed-screw which controls the radial position of the grinding wheel and which is adjusted to feed the wheel to the work and to compensate for wheel wear. Ordinarily, from four to six pieces can be ground before truing of the grinding wheel becomes necessary.

Grinding Outside of Crankcase Hub

A set-up for grinding the outside of a crankcase hub is shown in Fig. 4. In this case, the wheel-head and grinding wheel are mounted in an angular adapter *W*, which allows line contact only between the face of the grinding wheel and the work, thus improving the grinding action. The work-holding fixture is similar to the one shown in Fig. 3, except that it is provided with a different type of support at *H* to prevent the part from becoming distorted as a result of the thrust action of the grinding wheel. After the work is loaded into the fixture, these thrust-supporting members are clamped by tightening the knobs *J*.

In this particular set-up, the wheel is trued by the use of two diamond-holders, one at *Q*, which serves to dress the front face of the wheel, and the other at *P*, which dresses the inside diameter. In the first case, the wheel is stationary, and the diamond is passed across the face, whereas in the second case, the diamond is stationary and the wheel is fed past the diamond.

Grinding Angular Surface of Crankcase Web

The operation illustrated in Fig. 5 consists of grinding an angular surface on the central web of the crankcase section shown in Fig. 4. The machine used for this operation is arranged so that the work-head, which carries the faceplate and the work-holding fixture, can be set at an angle. The purpose of this is to allow the angular surface of the work that is in contact with the grinding wheel to be swung around, so that it will be square with the axis of the overhead slide-bar. Thus, the grinding wheel can be traversed back and forth, as shown by the positions indicated by the full and dotted lines, in order to cover the whole face to be ground. The grinding wheel is shown in the dressing position at the right in the illustration.

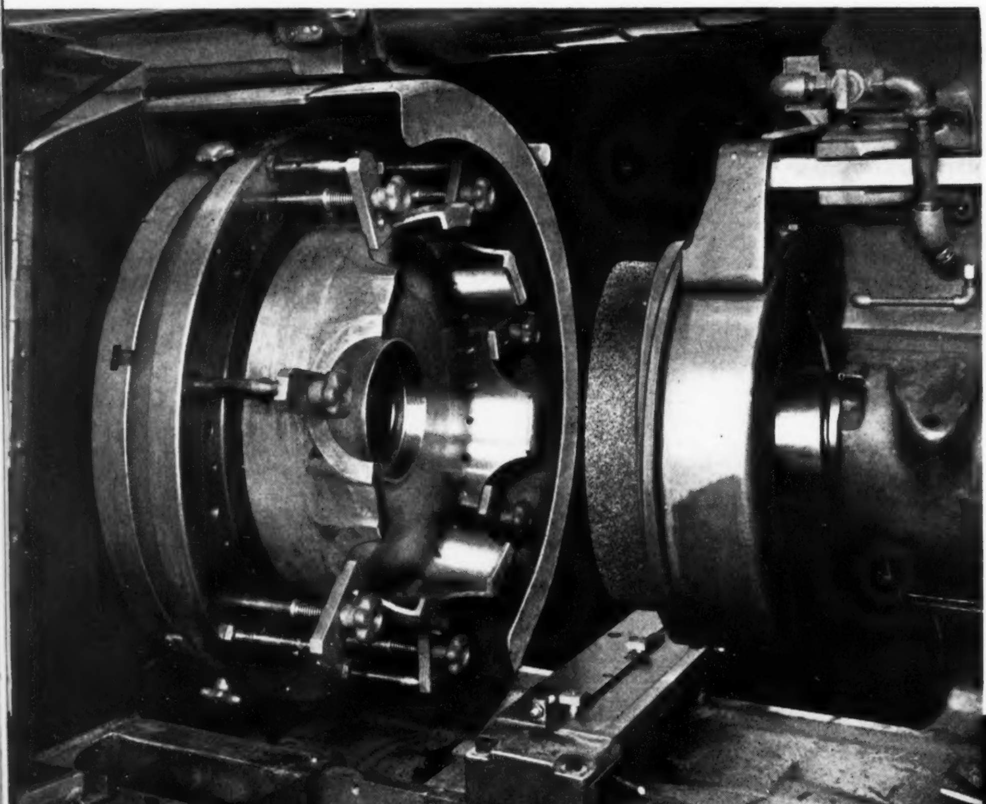


Fig. 11. Set-up for Grinding Portion of Web Face of Steel Crankcase Section

VICTORY

Grinding Crankcase Center Bores and Bearing Retainers

The final grinding operation on a steel crankcase for a single-bank engine is shown in Fig. 6. The work-holding fixture is similar to those previously shown. The operation, in this case, consists of finish-grinding the center bores and bearing retainers. It is necessary to bring the grinding wheel into five different positions, as indicated at *H*, *I*, *J*, *K*, and *L*, in order to completely finish this operation. The wheel is trued by two facing diamond-holders which are arranged to swing across the proper faces of the wheel.

A set-up for grinding grooves in the inside of a crankcase is shown in Fig. 7. An interesting problem connected with this job was the design of special grinding wheels and a suitable mounting arrangement.

Special Equipment for Grinding Bearing Retainers in Aluminum Crankcases

A 24-36 Bryant internal grinder equipped with telescoping feed-screw and a special diamond-holder for dressing the wheel used in grinding bearing retainers in an aluminum crankcase is shown in Fig. 8. The telescoping feed-screw provides for quickly shifting the grinding wheel from one position to another, and is used where two diameters of different sizes are to be ground. The handle with a black knob near the center of the machine feed-screw can be swung 180 degrees, causing the feed-screw to advance an amount, depending upon the eccentricity of the cam, that is independent of the ordinary advance movement obtained by rotating the whole feed-screw.

A succeeding operation on the crankcase shown in Fig. 8 is illustrated in Fig. 9, the crankcase front having been removed in this case to permit grinding the large bearing retainer in the center section. The operator is shown adjusting one of the precision stops on the machine. This stop permits the grinding wheel to advance slight amounts longitudinally, as required, when face-grinding.

Fig. 10 shows the same set-up as that illustrated in Fig. 9 from a slightly different angle.

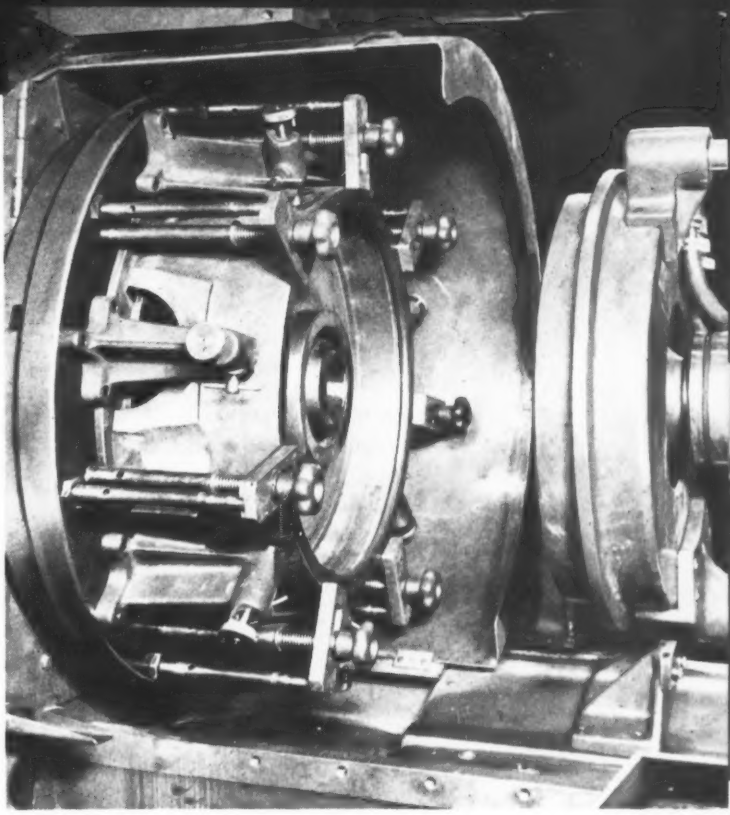


Fig. 12. Set-up for Groove-grinding Operation on Steel Crankcase Section of Wright Aircraft Engine

The standard Bryant wheel-dressing attachment is shown in the inoperative position. In this set-up, the wheel dresser is entirely automatic, and is used for dressing the outside diameter, or periphery, of the grinding wheel.

Grinding Inside Surfaces of Steel Crankcase

A set-up for grinding one of the inside surfaces of a steel crankcase section on a 24-B-36 Bryant grinder is shown in Fig. 11. This operation is somewhat similar to the one shown in Fig. 5, the part being shown as it appears after the grinding operation has been performed. Knobs for locking the thrust jacks which support the work are shown in the illustration.

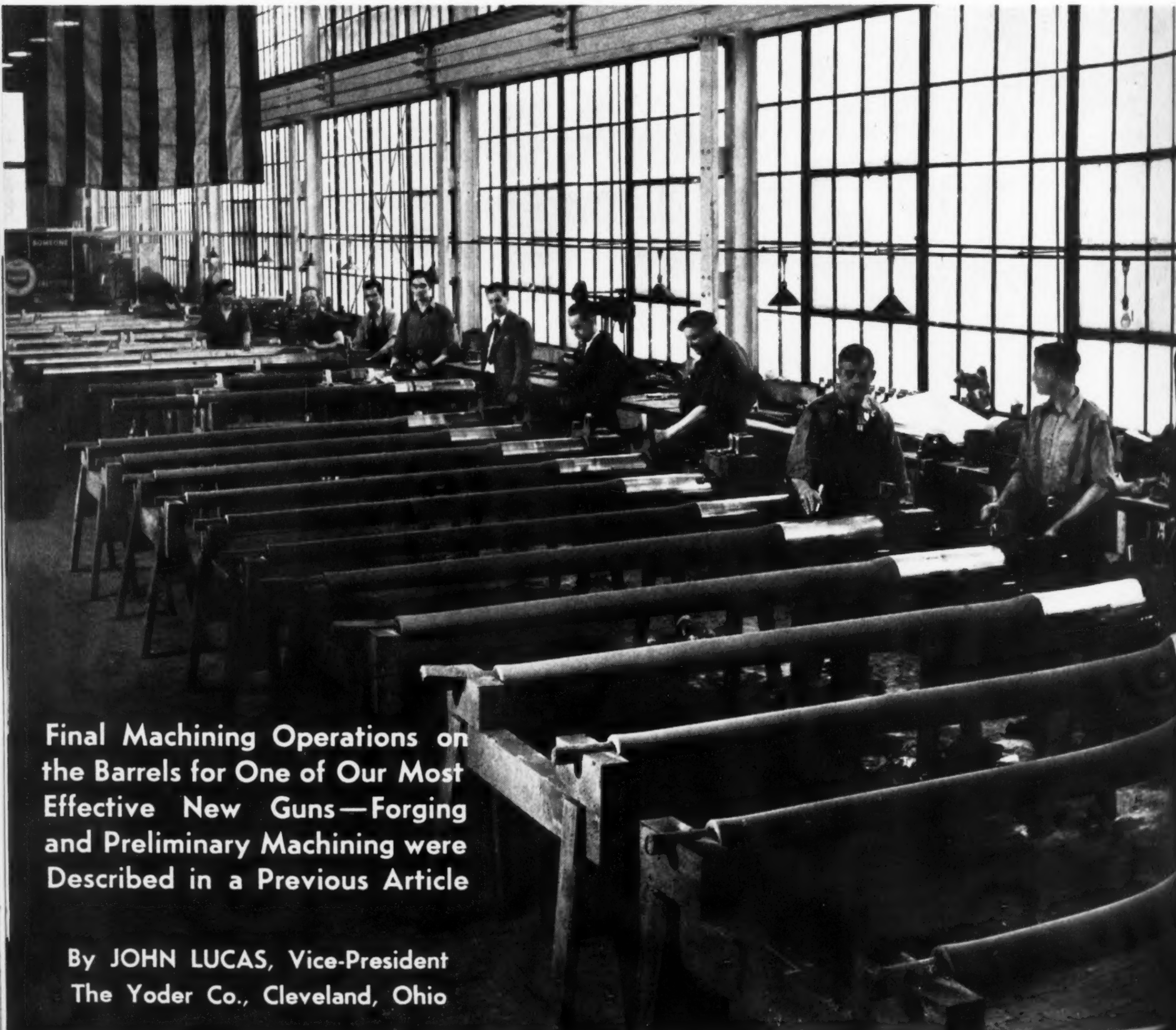
The work-holding fixture with the work in place, together with the wheel guard and wheel-head, shown on a 24-JW-36 Bryant grinder in Fig. 12, is the same as the set-up shown in Fig. 7. In Fig. 12, the work is shown in place ready for the actual grinding operation that produces the grooves indicated in Fig. 7.

Finishing 57-Millimeter Gun

THE spectacular success of the British Army in defeating Rommel's hordes on the African deserts has been due in a considerable degree to the effectiveness of the 57-millimeter anti-tank guns being turned out by American factories. The Yoder Co., Cleveland, Ohio, is a prime contractor for these guns complete, with the exception of the carriage. The barrels are received from a sub-contractor machined to the extent described in an article in April MACHINERY (see page 184), and are finished in the Yoder plant by the methods here outlined. The breech rings and blocks are received almost completely finished and are assembled to the barrels in the Yoder plant, ready for delivery to the War Department.

The first operation on the semi-finished gun barrels when they reach this plant is to check them for straightness, because no matter how carefully the barrels were machined and straightened in the plant of the sub-contractor, errors in alignment are likely to develop in the period intervening between semi-finishing and the arrival at the Yoder plant, due possibly to aging of the metal and other factors.

All barrels are therefore carefully examined for straightness, and the necessary corrections are made under the Farquhar 150-ton hydraulic press shown in Fig. 1. Readings are taken along the barrel bore every 8 to 10 inches. These readings are obtained by the use of a "telltale" or internal indicator which gives, in thousandths



Final Machining Operations on the Barrels for One of Our Most Effective New Guns—Forging and Preliminary Machining were Described in a Previous Article

By JOHN LUCAS, Vice-President
The Yoder Co., Cleveland, Ohio

Barrels

Fig. 1. Straightening is of Vital Importance during the Manufacture of Gun Barrels, and is Performed Four Times during the Finishing Operations

of an inch, any variation or run-out between the bore and the outside diameter of the tube. The variation is sometimes as great as 0.090 inch, but the gun barrels are straightened to within 0.003 inch before any finish-machining is started. Three additional straightening operations are performed during the finishing of the barrels.

In these straightening operations, the gun barrel is readily moved to various positions beneath the press ram by moving a bar that connects two carriages which normally support the barrel. It will be seen from the close-up view of one of these carriages in the left foreground that they run on ball-bearing rollers. When pressure is applied on a gun barrel, the carriage members that support the barrel are depressed, so that the bending force is carried by two anvils located between the carriages. The carriage members, being backed up by springs, automatically rise again each time the press ram descends. During straightening, readings are taken externally on the barrel by means of an indicator gage.

From the hydraulic straightening press the gun barrels are removed to an engine lathe in which the ends of the barrel are faced, a spot is turned near the center of the barrels for a steadyrest used in a succeeding lathe operation, and a chamfer is machined in the muzzle end of the bore to facilitate rifling later on. Then the barrel is transferred to a Lodge & Shipley lathe equipped with two carriages, similar to the machine shown in Fig. 2, for turning the entire length from the muzzle to the straight key section near the breech end, except the spot for the steadyrest. The changing contour is machined through the provision of a cam-bar at the back of the lathe bed to which both cross-slides are connected.

Stock to a depth of from 1/4 to 1/2 inch on the diameter is removed by Kennametal tools in this operation. One cutter is provided on the right-hand carriage of this preliminary turning operation, and two cutters on the other. The operation actually illustrated in Fig. 2 is the finish-turning of the barrel after rifling.

At the end of the lathe operation just described, the gun barrel is returned to the straightening press for a complete check on run-out, and then goes to another Lodge & Shipley lathe equipped with a taper attachment for turning the steadyrest spot and the breech end.

Next the gun barrels are routed to Warner & Swasey turret lathes, tooled up as shown in Fig. 3 for boring the powder chamber. The gun barrel is held in chuck jaws at the breech end, while the muzzle end is supported by a plug that fits into the gun bore. This plug is attached to a revolving plate which has a bearing in a long tubular casting mounted on the left-hand end of the headstock. Cutting coolant is flooded through this plug and the bore of the gun barrel to wash away all chips from the cutters. Coolant is also supplied directly to the cutters.

In setting up a gun barrel in these turret lathes, indicator readings are taken and adjustments made until concentric rotation is obtained. The readings are taken by means of a bar mounted on the turret which has a finger

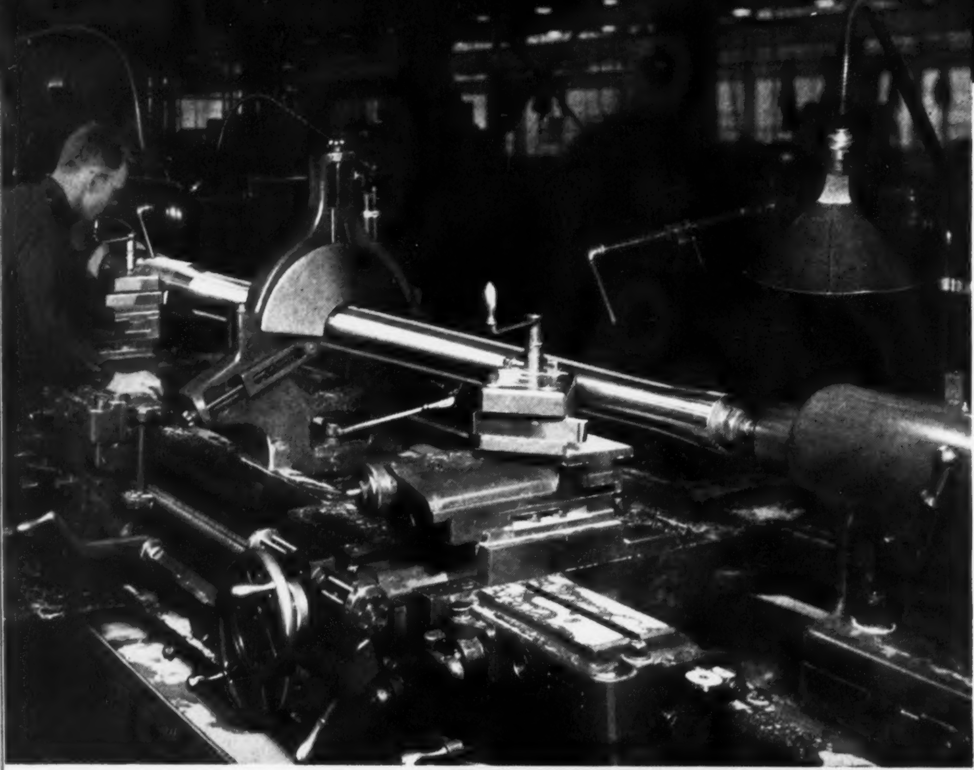


Fig. 2. Engine Lathes Equipped with Two Carriages and a Cam-bar for Controlling In and Out Cross-slide Movements are Employed for Semi-finish and Finish-turning Operations

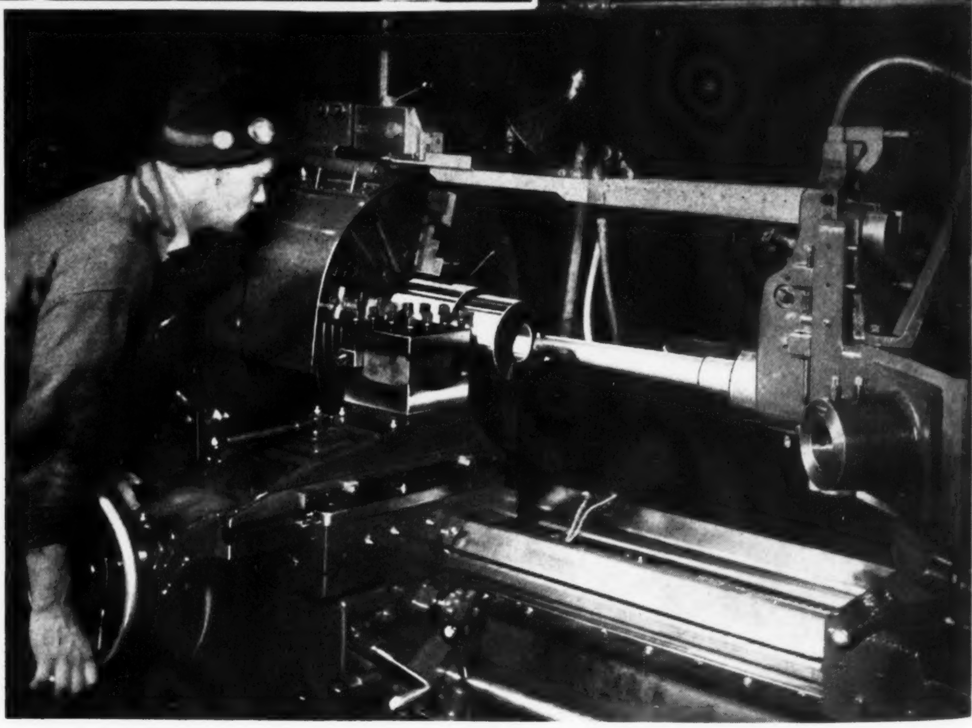


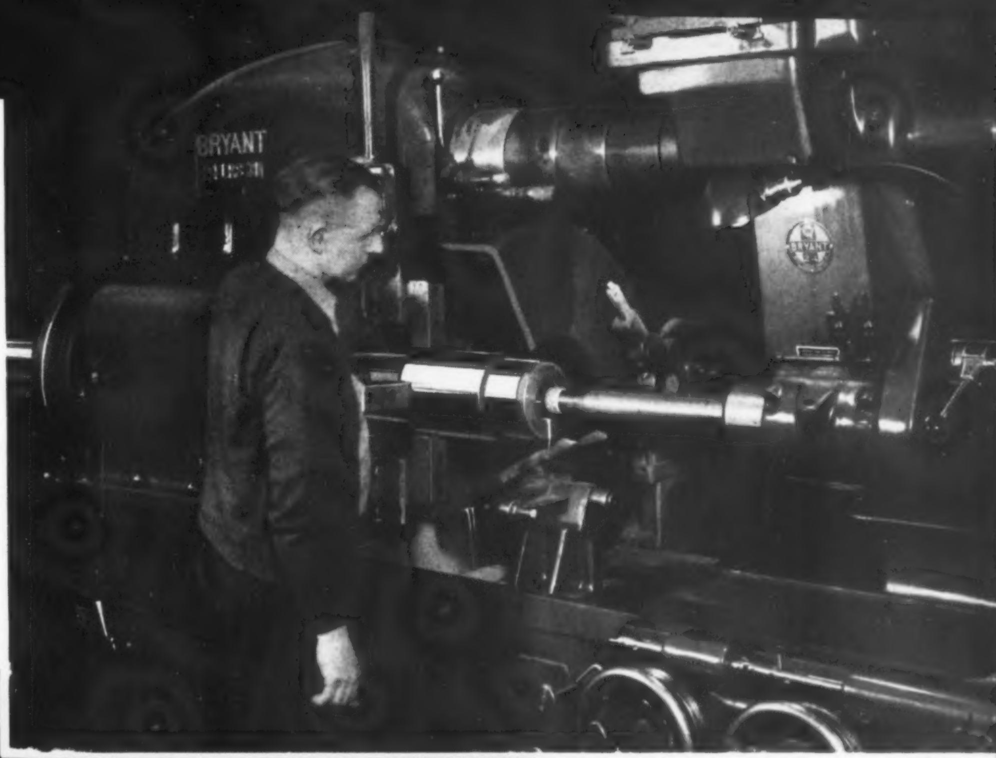
Fig. 3. Taper Boring Cuts on Powder Chamber are Performed on a Turret Lathe Equipped with a Cam-bar for Feeding the Tools Radially as They Move Lengthwise

at the front end that is advanced along the gun bore. Movements of the finger, which is actuated by eccentric rotation, are registered on a dial indicator located near the center of the hexagonal turret.

After concentric rotation has been obtained and the chuck jaws have been tightened, the first cut is taken, which consists of facing the breech end of the barrel by means of a tool mounted on the cross-slide. Then a long boring-bar on the turret, equipped with ten cutting tools which machine to several diameters, is fed into the gun bore. A pilot on the front end of the bar registers in the bore to insure concentricity of all surfaces. Cuts are taken to a distance of approximately 16 inches from the breech end of the barrel.

The turret is then indexed to bring the cutter-bar seen in the illustration into the cutting position, and as this bar is fed into the gun barrel, a cutter is applied for taking taper cuts. The cutter-bar is held on a slide that is fed downward as the bar is fed into the work, and a roller at the top of the slide follows along the top side of a long cam-bar that extends from the head-stock toward the right-hand end of the machine.

Fig. 4. Tapered and Straight Grinding Cuts are Taken on the Powder Chamber on a Chucking Grinder Equipped with Cam-bars for Moving the Grinding Wheel Radially



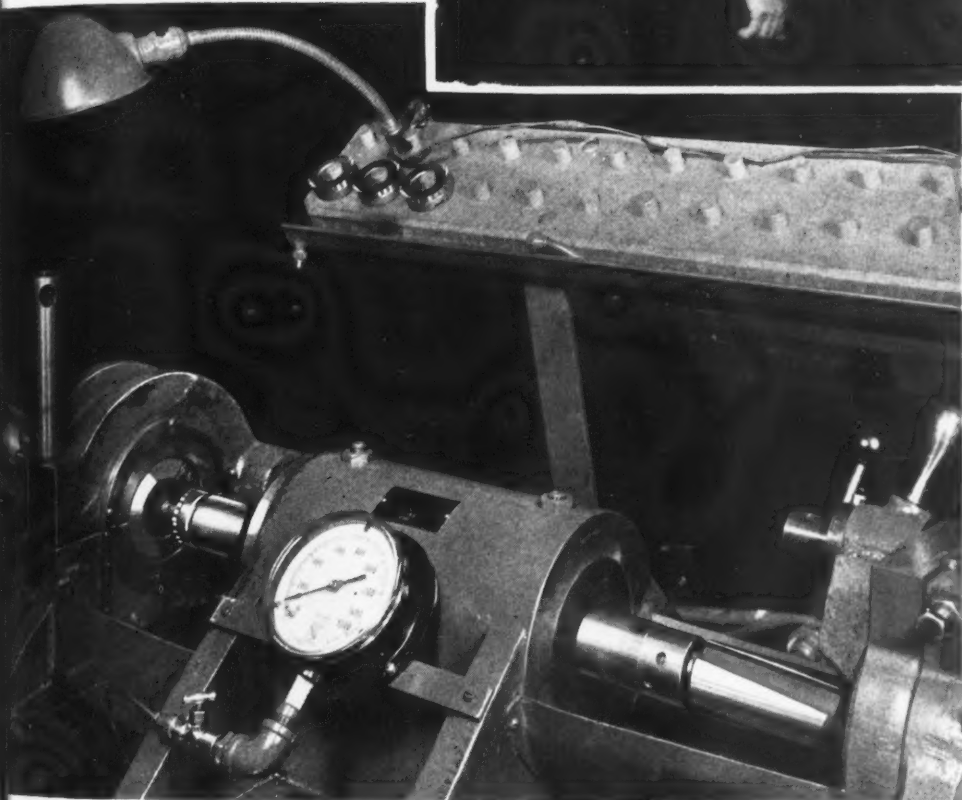


Fig. 5. The Gun Barrels are Rifled by Employing Twenty-five Disk-like Broaches, which are Interchanged on the Ram between Successive Strokes of the Machine

Spring pressure holds the roller against the cam-bar.

Finishing cuts are taken by tools mounted on a similar bar and slide at another station of the turret, and finally, a short tool-bar, also mounted on the turret, is advanced for rounding the corner of the powder chamber at the breech end of the barrel. About 0.010 inch of stock on the diameter is left by the turret lathe on the various bored surfaces for removal by grinding.

The grinding operation is performed in the Bryant chucking grinder shown in Fig. 4. Again, indicator readings are taken on the barrel during the set-up to insure concentric rotation throughout its length. Grinding is performed on four different surfaces, three of which are tapered. Two distinct operations are necessary. In the first, a surface about 14 inches long, which has a comparatively slight taper, and a "cone" about 2 inches long of sharp taper, are both ground. The wheel is fed radially at the required rate to produce the specified taper on both surfaces through the provision of a cam attachment at the back of the bed.

In the second operation, a straight centering cylinder, 1 7/8 inches long, and a short forcing

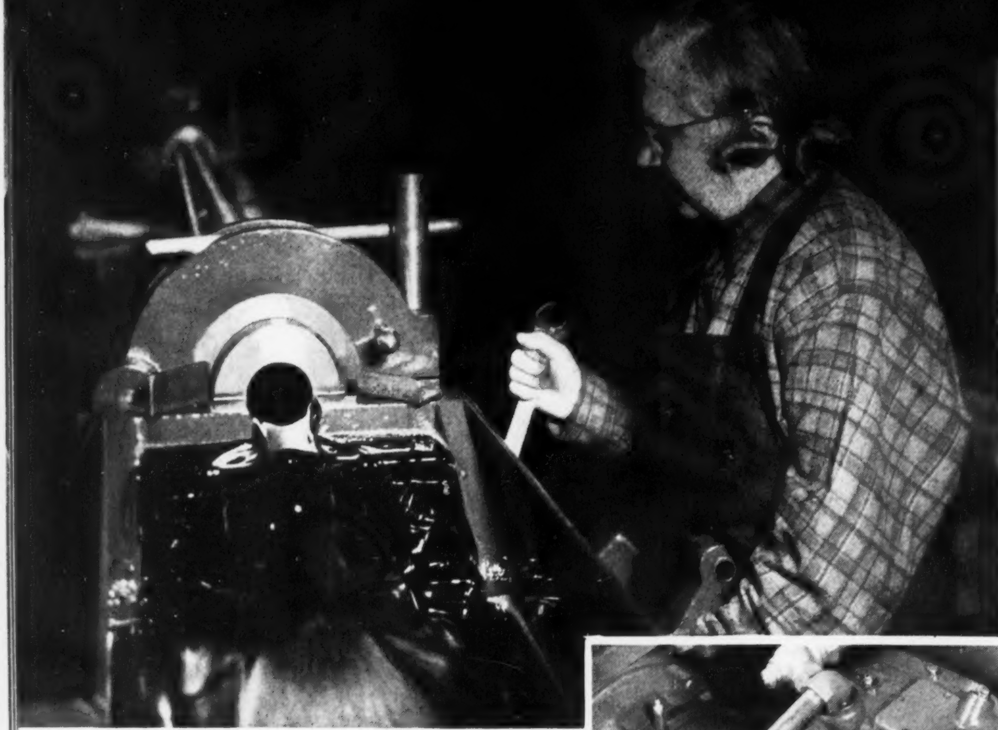


Fig. 6. View of the Broaching Operation from the Breech End of the Barrel. Note the Flood of Coolant that Keeps Broaches and Rifling Grooves Clean

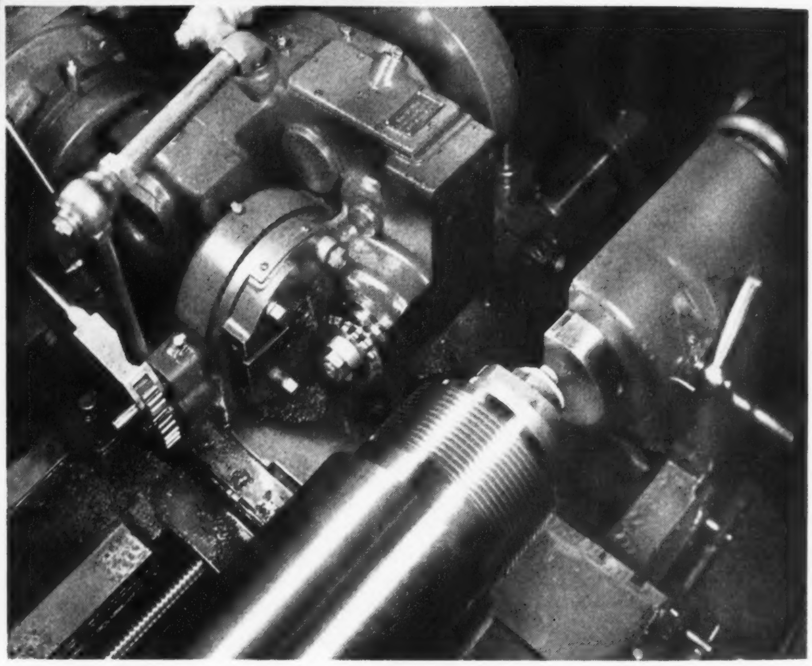


Fig. 7. Threads are Milled on the Breech End of the Barrel by Employing a Standard Thread Milling Machine in the Conventional Way

cone, about 1/2 inch long, are ground. A second cam is employed to control the radial feeding of the wheel in this operation, the machine being equipped with a dual control. The tolerance on the straight surface is plus 0.002 inch, minus nothing, while the tolerance on the tapered surfaces is plus 0.005 inch, minus nothing.

Rifling grooves are next broached in the gun bore by an American 12-ton horizontal push type broaching machine, a close-up view of which is shown in Fig. 5. Twenty-four grooves are machined simultaneously, as disk-like broaches with twenty-four cutting edges are individually pushed through the gun bore from the muzzle end to the breech. Several of these broaches may be seen on a board at the back of the broaching machine.

The broaches are mounted, one at a time, on the front end of the machine ram, which is provided with a helical groove that is engaged by a roller to control the path of the rifling grooves. With this arrangement, the broach ram is swiveled as it moves forward, and the rifling grooves are cut to the desired helix. Twenty-five broaches are used to cut the grooves to the specified depth, about 0.001 inch of stock being removed by each broach. The stock comes off in the form of long, continuous chips. The rifling grooves are about 92 inches long.

Cutting coolant is flooded through the gun bore from behind the disk broaches, and emerges from the breech end during the operation, as seen in Fig. 6, so as to wash away all chips and assure rifling grooves of high quality. The broaches are quickly mounted on the machine ram at the muzzle end of the gun barrel between

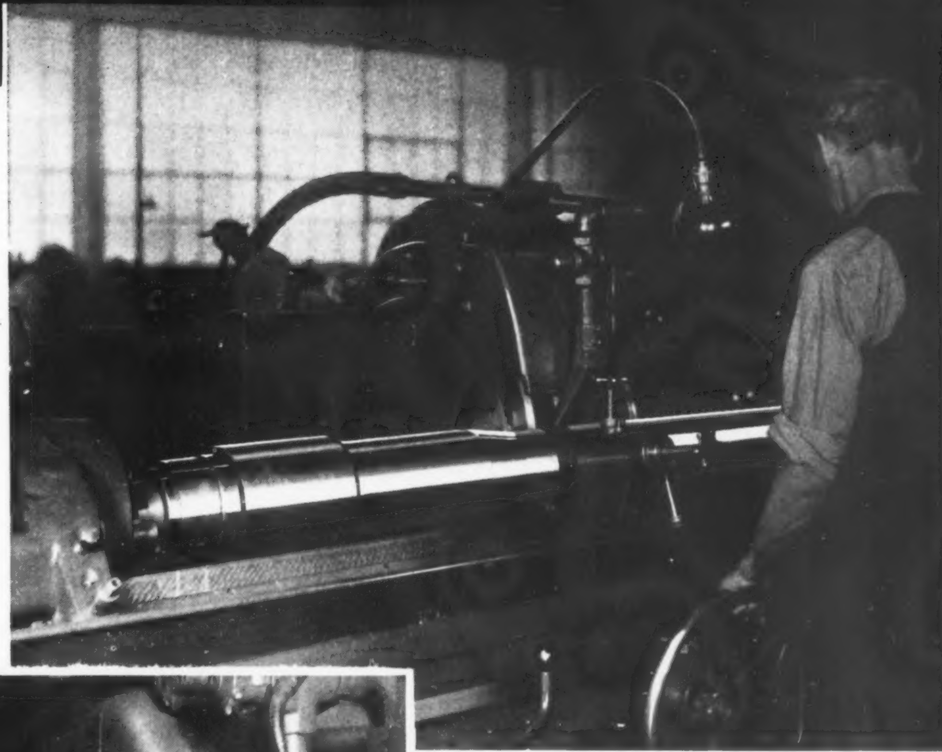


Fig. 8. One of Two Grinding Operations in which the Barrels are Finished for their Full Length, Except for a Portion Later Cut away to Obtain Integral Keys

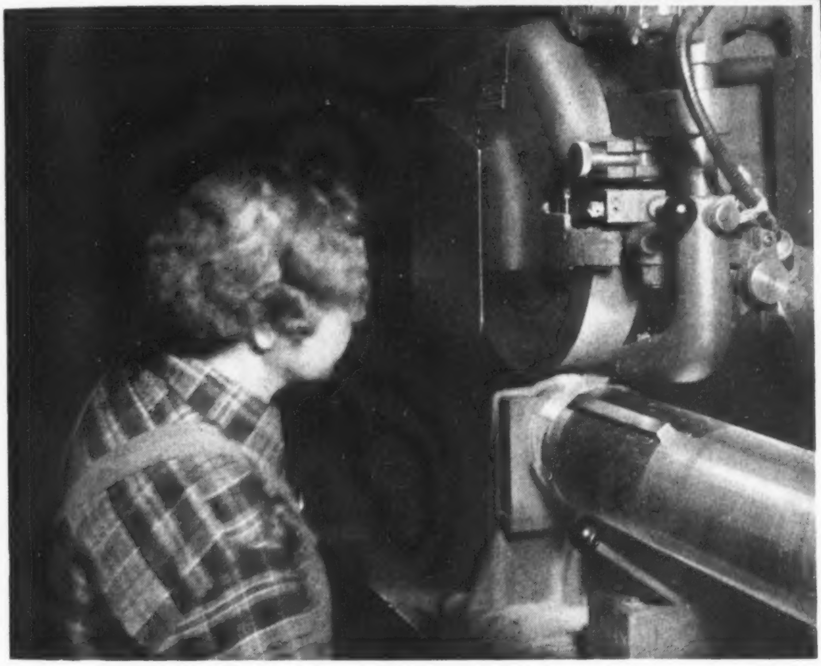


Fig. 9. After Integral Keys have been Shaped as Shown in Fig. 10, the Surfaces between the Keys are Finished by Grinding

successive strokes of the ram, and removed at the breech end before the return strokes. To insure that the broaches will be used in their proper sequence, they are placed by the operator at the breech end on wooden pegs in an adjacent box. Another girl mounts the broaches on the ram.

Upon the completion of the rifling, the gun barrels are turned over to inspectors for a careful visual inspection of the grooves throughout the full length of the gun bore. This is done by means of a Gurley Borescope. The barrels are then placed in an engine lathe for again turning a spot for a steadyrest and for finish-turning the breech end.

Next the gun barrels go to the Lodge & Shipley double-carriage lathe illustrated in Fig. 2 for finish-turning. As the carriages are fed along the bed, the cross-slides are automatically moved radially under the control of a cam-bar at the rear of the bed. It will be observed that the cross-slides are equipped with special tool-blocks which can be swiveled and clamped in the most suitable positions for turning to the required contour. Kennametal cutters are employed in this operation, the same as in the preliminary turning operation. The barrel is turned for the full length up to the straight key section near the muzzle end, about 0.015 inch of stock on the diameter being left for removal by grinding.

The gun barrels are next returned to the straightening press for a final checking and correction. This inspection is done completely from external surfaces, as a "telltale" indicator could not be applied readily in the rifled bore.

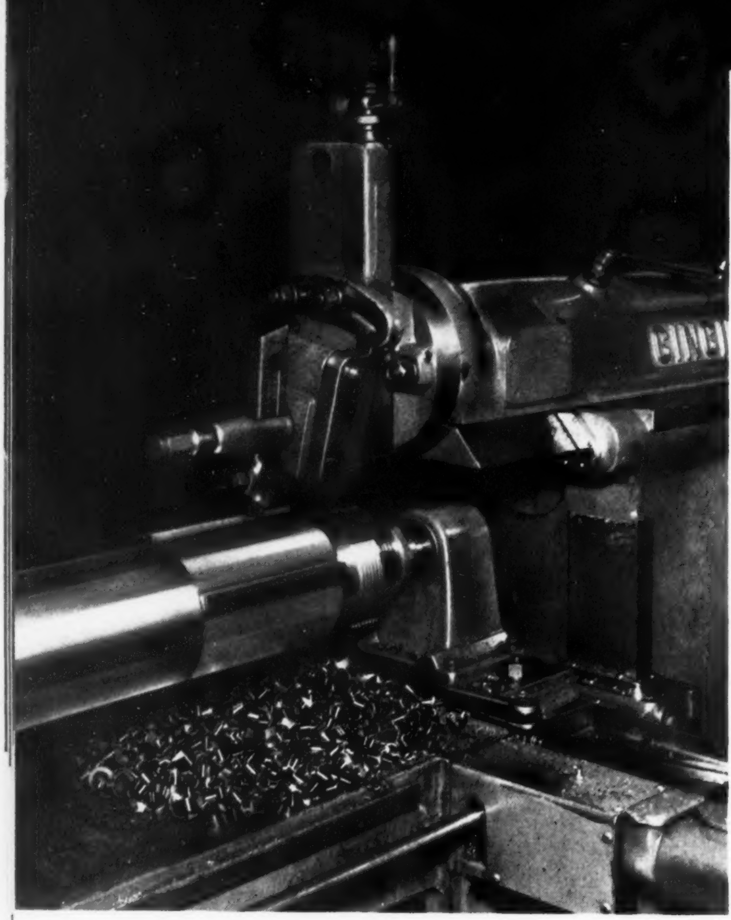


Fig. 10. Shaping away Stock to Obtain Two Integral Keys on Opposite Sides of Barrel, the Roughing Cut being 5/8 Inch Deep

After they have been straightened, the gun barrels are ground externally for the full length, with the exception of the curved section near the muzzle end. This is accomplished in two operations on Cincinnati cylindrical grinding machines of the type shown in Fig. 8. One of these machines is equipped for taper grinding, while the other finishes cylindrical surfaces only.

Then the Pratt & Whitney thread milling machine shown in Fig. 7 is applied for milling threads for the breech-ring. The modified Acme thread form is used, and there are four threads per inch. The lead is controlled from the regular lead-screw of the machine.

Next the gun barrels are transferred to a row of Cincinnati shapers, which are employed, as shown in Fig. 10, for cutting away stock from the thick cylindrical section near the breech end of the gun barrels to form two integral keys. In the same set-up of the barrels, and either before or after the keys are cut, stock is cut away at several points around the breech threads so as to produce interrupted threads. This step of the operation had already been performed when the photograph was taken.

Only two cuts are taken in machining the keys—first a roughing cut 5/8 inch deep, and then a light finishing cut, which leaves about 0.015 inch of stock on the diameter for removal by grinding. During the shaping operation, the gun barrel is indexed at regular increments between strokes of the ram by a device mounted at the outer end of the extended table that supports the barrel. This indexing device is driven from the regular feed mechanism of the machine. A feed of 0.020 inch is ordinarily used.

The grinding of the surfaces between the two keys is next performed on a Mattison surface grinding machine, set up as illustrated in Fig. 9. In starting an operation, one side of the lugs is positioned against a stop. Then, between successive strokes of the table past the wheel, the gun barrel is indexed by hand from the right-hand end of the table until the second key is reached. The operation is now duplicated on the other surface between the two keys. The

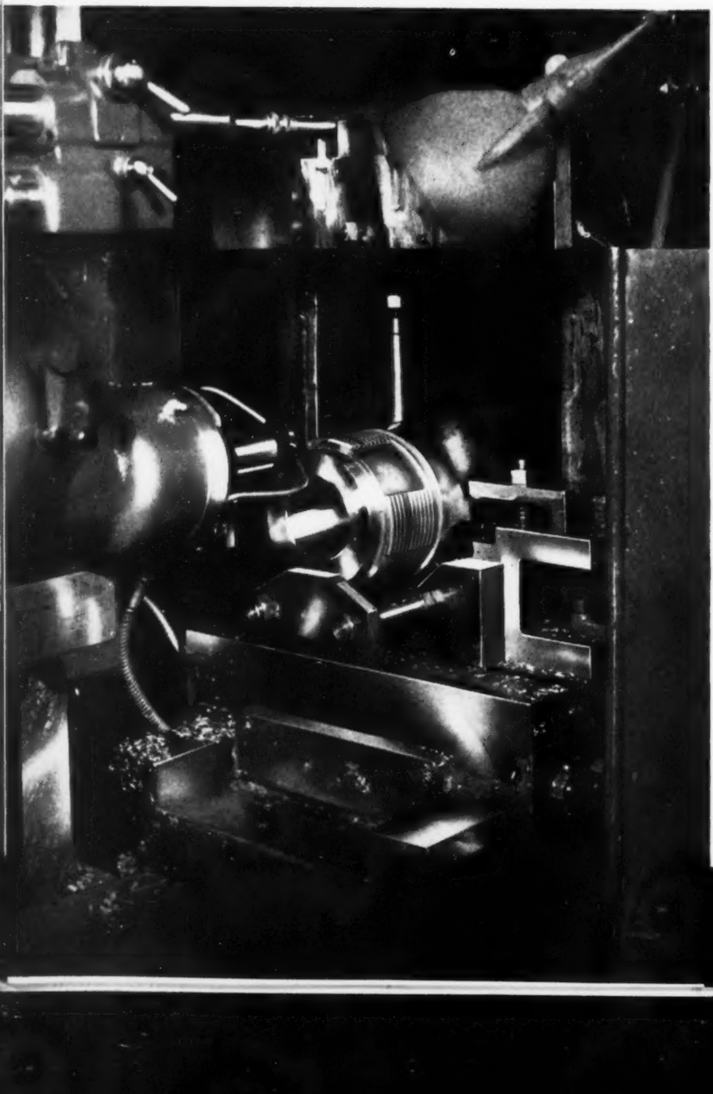


Fig. 11. Milling Extractor Slots to Irregular Outline, and to Three Different Depths, on the Breech End of a Gun Barrel

Fig. 12. Sawing the Gun Barrel to Prescribed Length after the Performance of All Machining Operations

grinding wheel is dressed to the radius of the gun barrel at the surface being ground.

Extractor slots are milled in the breech end of the gun barrel by a Kellermatic automatic tool-room machine shown in Fig. 11. The shape of the slots is controlled in the conventional manner by a templet mounted above the work. Three cutters, two of ball end type and one end-mill, are employed. Surfaces are milled at three different depths.

Fig. 12 shows the final operation before the gun barrels go to the paint spray and assembly stands. This consists of cutting off the muzzle end to obtain the specified barrel length, and is performed in a Racine hydraulic sawing machine. A general view of the paint spraying and gun assembly department is shown in the illustration on page 140.

Testing the Strength of Ship Chains

EVERY foot of chain manufactured for the United States Navy or the United States Maritime Commission by the S. G. Taylor Chain Co. is given a strength test before being shipped to insure that it meets specifications. The tensile testing operations are performed on the machine here illustrated, which develops a heavy force through a hydraulic cylinder.

One end of the chain to be tested is attached to a holding device, which is fastened to the end of the piston-rod of the hydraulic unit. The other end of the chain is attached either to a jaw that is embedded in the concrete at the opposite end of the concrete trough in which the chain is placed for the test, or to a block at the end of another chain which is fastened to the jaw embedded in the concrete. The trough is long enough for testing chain up to 90 feet.

Every Foot of Chain Supplied by the S. G. Taylor Chain Co. for Use Aboard Ship is Subjected to a Tensile Strength Test

Forging and Heat-Treating

INGENIOUS application of existing manufacturing equipment enabled the St. Louis plant of the Axelson Mfg. Co. to convert from peacetime products to war munitions. This plant normally forges and machines sucker rods used in great quantities in the oil fields. It is now engaged in forging armor-piercing shot bodies and caps for 37-millimeter projectiles used in anti-tank guns, along with various other munitions items. Only a negligible amount of special equipment, such as gages, forging dies, and gravity conveyors, had to be provided in order to effect satisfactory conversion.

One complete round of armor-piercing ammunition is shown at the right in the heading illustration on page 149. At the left are seen a shot body and a cap in the forged and heat-treated condition in which they are shipped from the Axelson plant to other concerns for machining. One of the machined shot bodies and a finished cap are seen to the right of the rough forgings as they are finished by the other companies, ready for assembly into a projectile. The projectile assembly, consisting of a body, a cap, and an aluminum windshield, is shipped by the company that does the machining to a shell loading plant, where it is crimped in the open end of an explosive-loaded cartridge case to form the complete round.

Upon contact of these projectiles with their objectives, the aluminum windshield disintegrates and the hard, brittle cap breaks the surface of the tank armor plate as it also flies apart. In so doing, the cap prepares a spot for the less hard, but tougher, shot body to penetrate the armor plate. The cap also effectively prevents the projectile from ricocheting.

The shot bodies are solid forgings. They are produced from 1-inch round bars which are received in lengths up to about 10 feet. These bars are heated in furnaces fired by natural gas. Micromax indicating and recording potentiometers insure a close control of the furnace temperatures. As the bars are taken from a furnace they are run under a rotary wire brush, mounted on a motor-driven floor-stand grinding machine, to remove all loose scale.

Forging of the shot bodies is performed in Ajax upset forging machines, a typical operation being illustrated in Fig. 1. The machines are equipped with dies of the construction illustrated in Fig. 3, in which the punches are shown on top of the die halves. In an operation, the stock is successively placed in each of the die impressions, beginning at the top. The stock is necked in the first impression to a diameter small enough to fit the opening at the front end of the die insert in the second impression. The necking is accomplished by operating the machine a number of times and rotating the bar of stock small amounts between operations.

When the stock is placed in the second impression, it is upset to somewhat larger dimensions, and the conical nose is started as a punch provided with a hollow insert (shown at position *B*, Fig. 4) moves into the closed die. When the stock is placed in the third impression, another punch with a hollow insert (shown at position *C*, Fig. 4) is advanced to continue the formation of the conical nose and to upset the shot body in back of the nose to a still larger diameter.

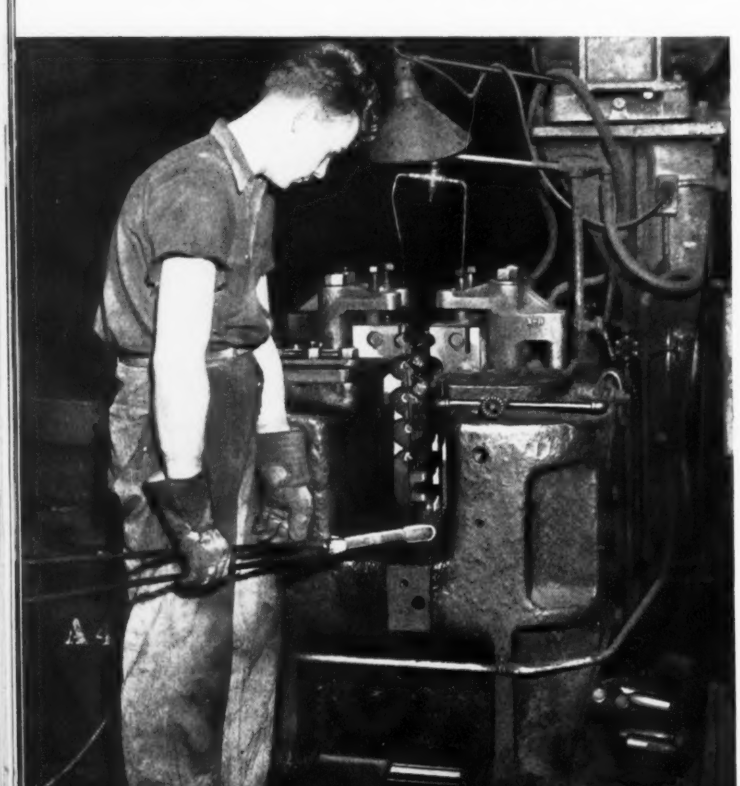


Fig. 1. One of the Forging Machines that Produce the Armor-piercing Shot Bodies from Round Bar Stock

Shot for Anti-Tank Projectiles

Shot Bodies and Caps for 37-Millimeter Armor-Piercing Projectiles are Now being Produced in a Plant of the Axelson Mfg. Co. that Ordinarily Makes Sucker Rods for the Oil Fields

By ROBERT M. PEASE, Vice-President
The Axelson Mfg. Co.
St. Louis, Mo.

***(Right)* 37-millimeter Armor-piercing Projectile; *(Left)* Rough-forged Shot Body and Cap; *(Center)* Finish-machined Shot Body and Cap**

While the stock is in the fourth and fifth impressions, the shape of the shot body is completed, as indicated at *D* and *E*, Fig. 4. With the stock in the fifth impression, the machine is again operated three or four times and the forging turned partially between each closing of the dies, so as to insure proper size and shape. Finally, the forging is transferred to the sixth die impression, as shown at *F*, where shearing blades are provided for cutting it from the bar of stock. At the end of this operation, the shot bodies fall into a chute that leads to the right-hand side of the machine, as seen in Fig. 1. The forged shot bodies are 4 1/2 inches in length, and must be 1.57 inches maximum diameter within close tolerances.

Adjacent to the forging machines that produce the shot bodies is similar equipment for forging the caps. Fig. 2 shows a National forging machine being employed for this operation. Although the dies were made with five cavities or impressions, the next to the bottom impression was found unnecessary, and is no longer used. As the caps fall from the dies they drop into a chute which carries them to the small Toledo punch press illustrated in Fig. 6, where the flash is trimmed off by a die.

The shot bodies are annealed in a large conveyor furnace, 32 feet wide by 36 feet long, which was built by the Salem Engineering Co. for handling sucker rods in large quantities. In heat-treating sucker rods, this furnace is in constant motion, but shot bodies must be held in the furnace for a much longer period of time.

Fig. 2. One of the Forging Machines that are Employed for Upsetting the Caps from Tungsten Steel

To provide for the longer heat-treatment, the chain conveyor is operated to feed the shot bodies into the furnace, stopped for the required period of heat-treatment, and again started up to carry the annealed bodies from the furnace.

In order to use this equipment for shot bodies, it was necessary to provide some means of holding the bodies during the operation. The problem was solved by purchasing used boiler flues and loading them from end to end with shot bodies. The flues are fed into the furnace in the manner illustrated in Fig. 5, where bodies

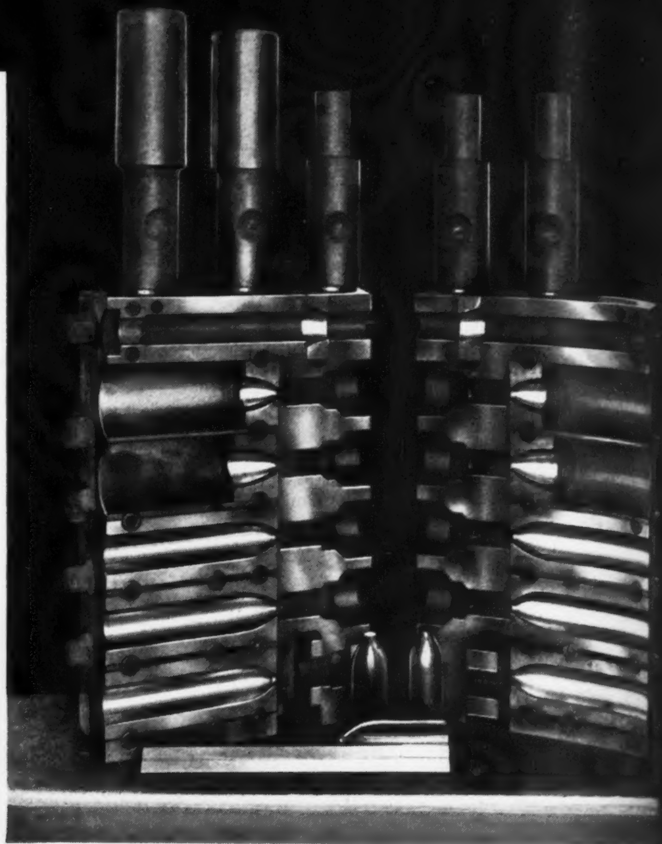


Fig. 3. Dies and Punches Provided on the Forging Machines that Produce the Shot Bodies

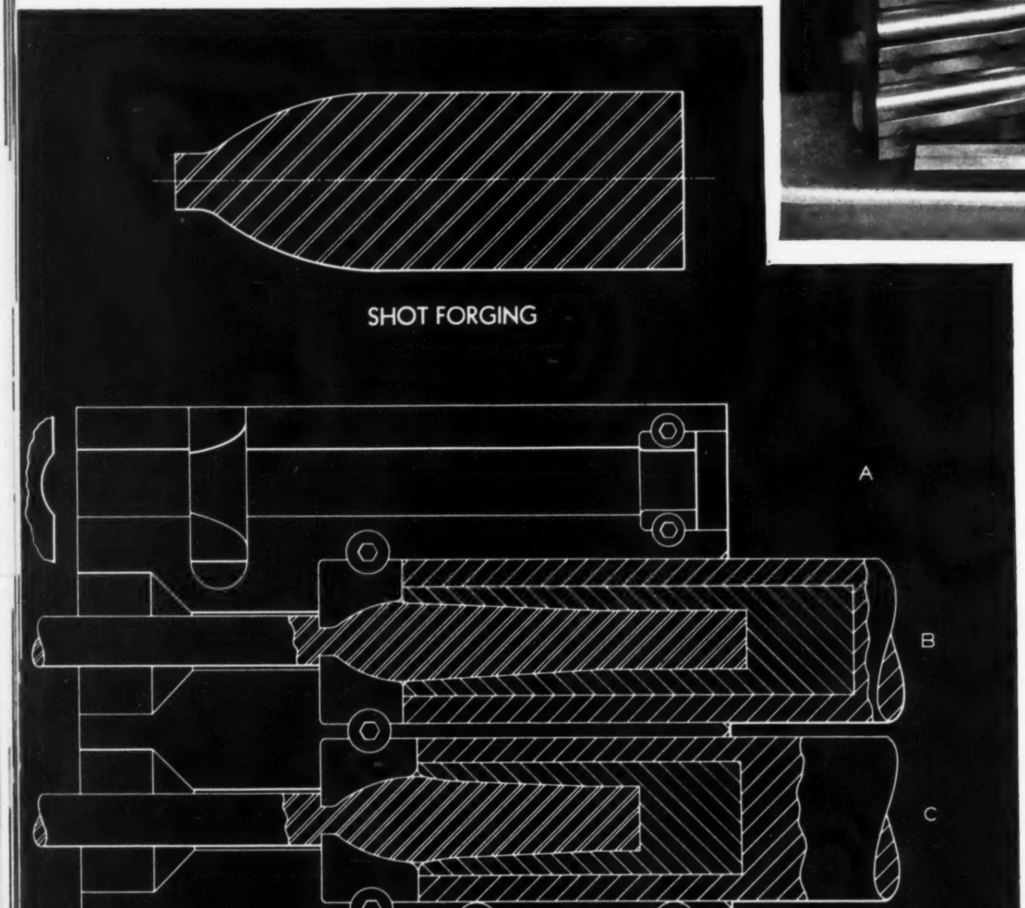


Fig. 4. (Left) Drawing of One of the Die Halves, with the Punches Shown in the Working Positions to Illustrate the Successive Steps in the Forging of a Shot Body

Fig. 5. (Bottom of Opposite Page) The Shot Bodies are Loaded into Long Boiler Tubes for the Annealing Process, which is Conducted in a Large Conveyor Type Furnace

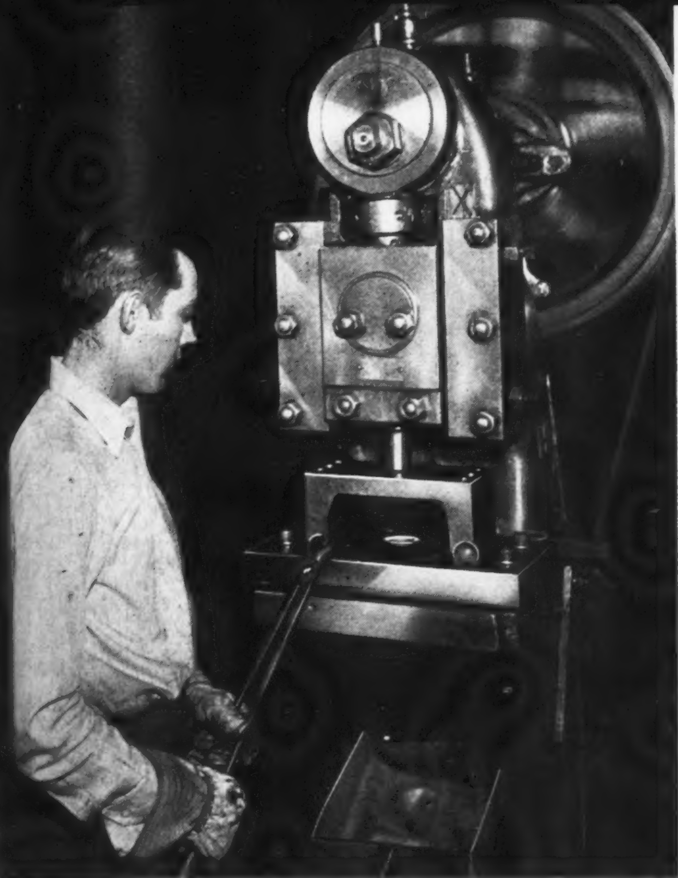


Fig. 6. Punch Press Set-up Employed for Shearing the Flash from the Open End of the Caps

Fig. 7. Caps are Annealed in This Gas-fired Furnace, About 11,000 Caps being Handled at One Time

can be seen projecting from the ends of the flues. The flues can be used fifteen to twenty times before they have to be discarded.

The furnace is brought to the required temperature prior to loading by four rows of natural gas burners. There are sixteen burners in each row, or sixty-four in the entire furnace. Three rows of burners are below the work, and one above. The shot bodies are held at the required temperature for a sufficient time to normalize the "as forged" structure. They are then permitted to cool and held for a time at a reduced temperature, after which they are allowed to cool in the furnace to a still lower temperature. This cooling period is varied somewhat, depending upon the exact analysis of each heat

Fig. 8. To Eliminate Cracking, the Caps are Held in Ovens between the Forging and Annealing Operations

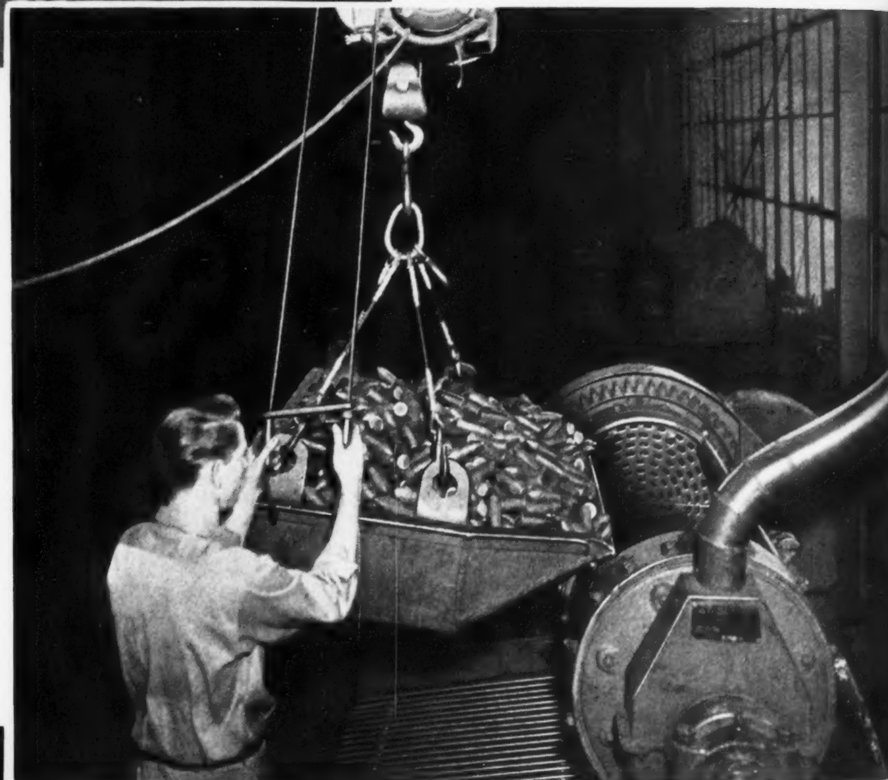


Fig. 9. The Shot Bodies are Tumbled in Order to Remove All Scale and Sharp Edges

Fig. 10. A Flat is Milled on About 10 Per Cent of the Shot Bodies to Prepare Them for a Hardness Reading

Fig. 11. Type of Machine Employed in Determining the Brinell Hardness of the Shot Bodies

Fig. 12. View of Inspection Bench where Shot Bodies are Checked for Length and Diameter

Fig. 13. Shot Bodies that are Too Long to Pass Inspection are Ground off on a Floorstand Grinding Machine

Fig. 14. (Left) The Caps are Inspected for Length, Thickness of Closed End, and Diameter by Applying the Gages Here Shown

Fig. 15. (Below) View of Inspection Room and Gravity Conveyor that Carries the Caps and Bodies to Shipping Department

of steel, in order to attain the specified hardness. The shot bodies are then removed from the furnace for cooling in the shop atmosphere. There are several heating zones in the furnace, all of which are controlled by Micromax instruments.

The cap forgings require more care in heat-treatment. They are placed in steel baskets, held in a small gathering oven located beside the punch press. When full, the baskets are transferred to the large pit oven seen in Fig. 8. They are kept at the required temperature in these ovens. The pit oven is long enough to accommodate six baskets of caps, and each basket holds approximately 1200 caps.

Annealing of the caps is performed in the Lindberg "Super Cyclone" gas-fired furnace illustrated in Fig. 7, which receives work baskets 38 inches in diameter by 60 inches high. These baskets are filled about three-fourths, which equals approximately 11,000 caps.

The shot bodies are transported from the annealing furnace to Cleveland automatics, which cut off the slight flash from the large end left after the forging operation. They then go to the Sly tumbling barrel shown in Fig. 9, where they are tumbled in steel stars for forty-five minutes. About 1300 bodies are loaded into the barrel at a time, loading being facilitated by

the use of a large steel scoop and a 1 1/2-ton hoist, as shown. An exhaust pipe carries away the dust resulting from this operation. The tumbling barrel is about 24 inches inside diameter by 6 feet long. The caps are sand-blasted rather than tumbled.

About 10 per cent of the shot bodies are checked for hardness, this inspection being performed after tumbling. The bodies to be checked are milled flat for a width of 3/4 inch on one side and to a depth of 3/64 inch, in order to provide a surface for the hardness test that will give a true reading, instead of an indication of the surface condition only. Milling of this flat is performed on a production basis, as shown in Fig. 10, by the use of a two-spindle Cincinnati milling machine, equipped with a special fixture having a capacity for holding twenty-four bodies at a time. The cutters used for the operation are 3/4-inch end-mills.

The hardness test is performed on a Tinius Olsen machine of the type illustrated in Fig. 11. The caps are also checked for hardness with the same equipment after sufficient metal is removed from the nose to eliminate a false reading due to surface conditions.

The shot bodies are next passed to the inspection bench seen in Fig. 12 for checking the length and diameter. There is a tolerance of 1/8 inch on the length, but the diameter must be of the specified size within plus nothing, minus 0.020 inch. "Go" and "Not Go" snap gages are employed. Fluorescent lighting tubes insure adequate illumination of the inspection benches. The small number of shot bodies that are too long to pass inspection are ground to the proper length on the Queen City floor-stand grinder shown in Fig. 13. The operators of this machine are provided with working gages, so that they can check the length of the bodies while the grinding operation is being performed.

The caps are checked for over-all length, thickness of head, diameter, and concentricity of cavity with the outside. "Go" and "Not Go" and concentricity gages of the types shown in Fig. 14 are used in checking the caps.

Shot bodies and caps that pass inspection are packed in cardboard boxes and carried by the Rapids Standard gravity conveyor seen in Fig. 15 to the shipping department. An interesting feature of this conveyor is the use of ball-bearing rollers such as are commonly used on roller skates.

The plant is provided with a well equipped metallurgical laboratory, a general view of which is shown in Fig. 16, for keeping a close control of the quality of incoming raw materials and outgoing products. The Tinius Olsen tensile testing machine seen at the right has a capacity of 100,000 pounds.

Fig. 16. General View of the Metallurgical Laboratory, which Controls the Quality of Incoming Raw Materials and Outgoing Products

Machining 37-Millimeter Armor-Piercing Shot

How Bullard Mult-Au-Matics Have been Adapted for the Production of Small-Sized Projectiles

By HOLBROOK L. HORTON

IN these days of machine tool scarcity and difficulties in delivery, conversion from the manufacture of peacetime to wartime products may be aided considerably by the versatility of the machine tools already installed. This proved to be true in the case of a manufacturer of gasoline pumps who contracted to make 37-millimeter armor-piercing shot.

Bullard 8-inch Mult-Au-Matics had been used during regular peacetime operations for machining the pump parts. For shell production, this size of Mult-Au-Matic would ordinarily be used on sizes up to 3 inches. Since smaller models of this type of machine tool were not available, however, consideration was directed toward utilizing the larger models for machining the 37-millimeter armor-piercing shot, even though the rate of production would necessarily be somewhat lower. The machine tool maker was consulted, and he decided that, although the arrangement was only a makeshift, a satisfactory operation schedule could be worked out.

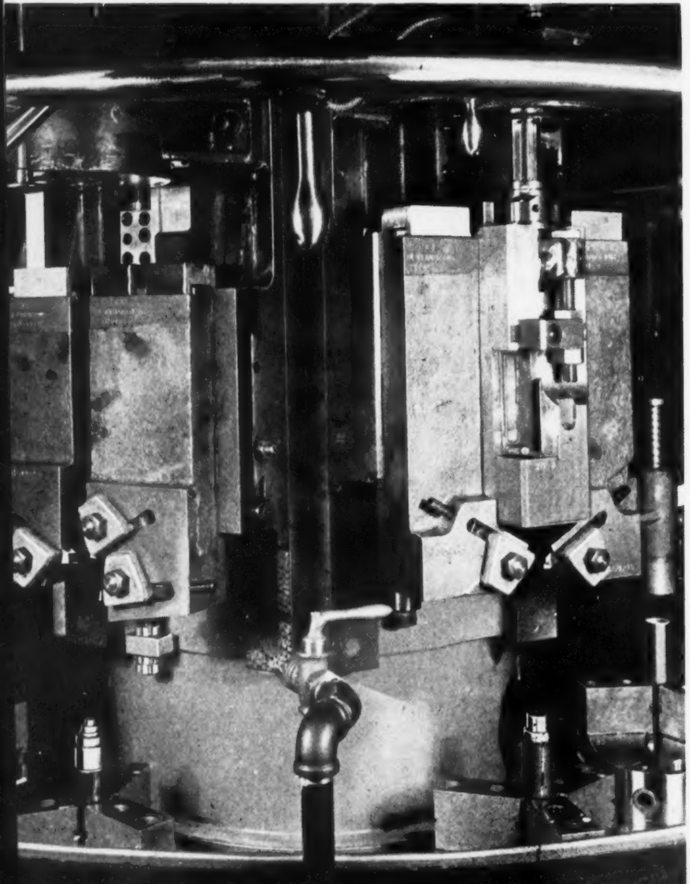


Fig. 1. Bullard Mult-Au-Matic Tooled up for Machining Nose End of 37-millimeter Armor-piercing Shot. From Right to Left is Seen Work as It Appears after Operations at First, Second, and Third Stations

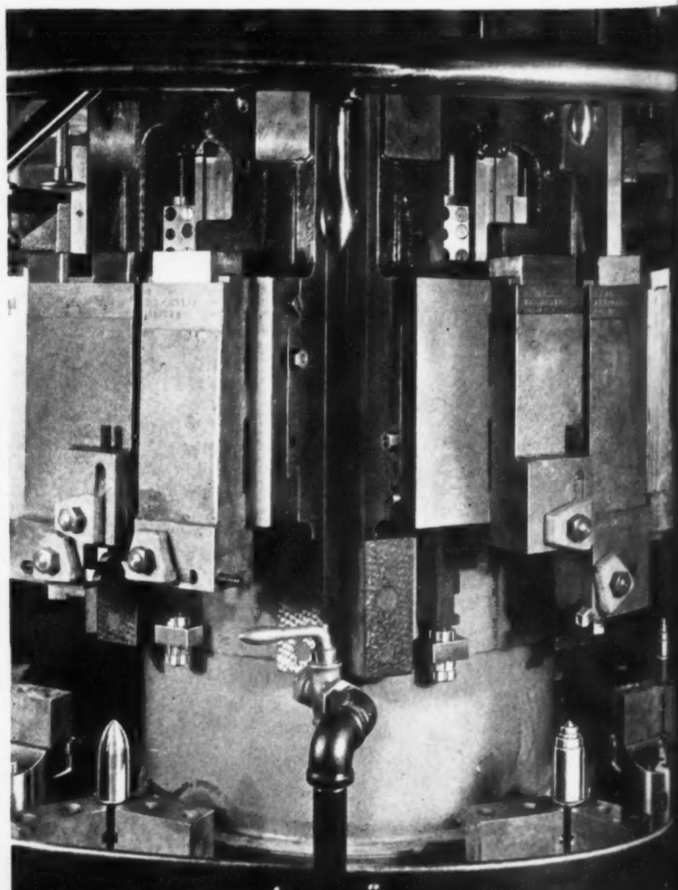


Fig. 2. View of Equipment Illustrated in Fig. 1, Showing, from Right to Left, the Nose Sections of the Shot as They Appear after Operations have been Performed at the Third, Fourth, and Fifth Stations

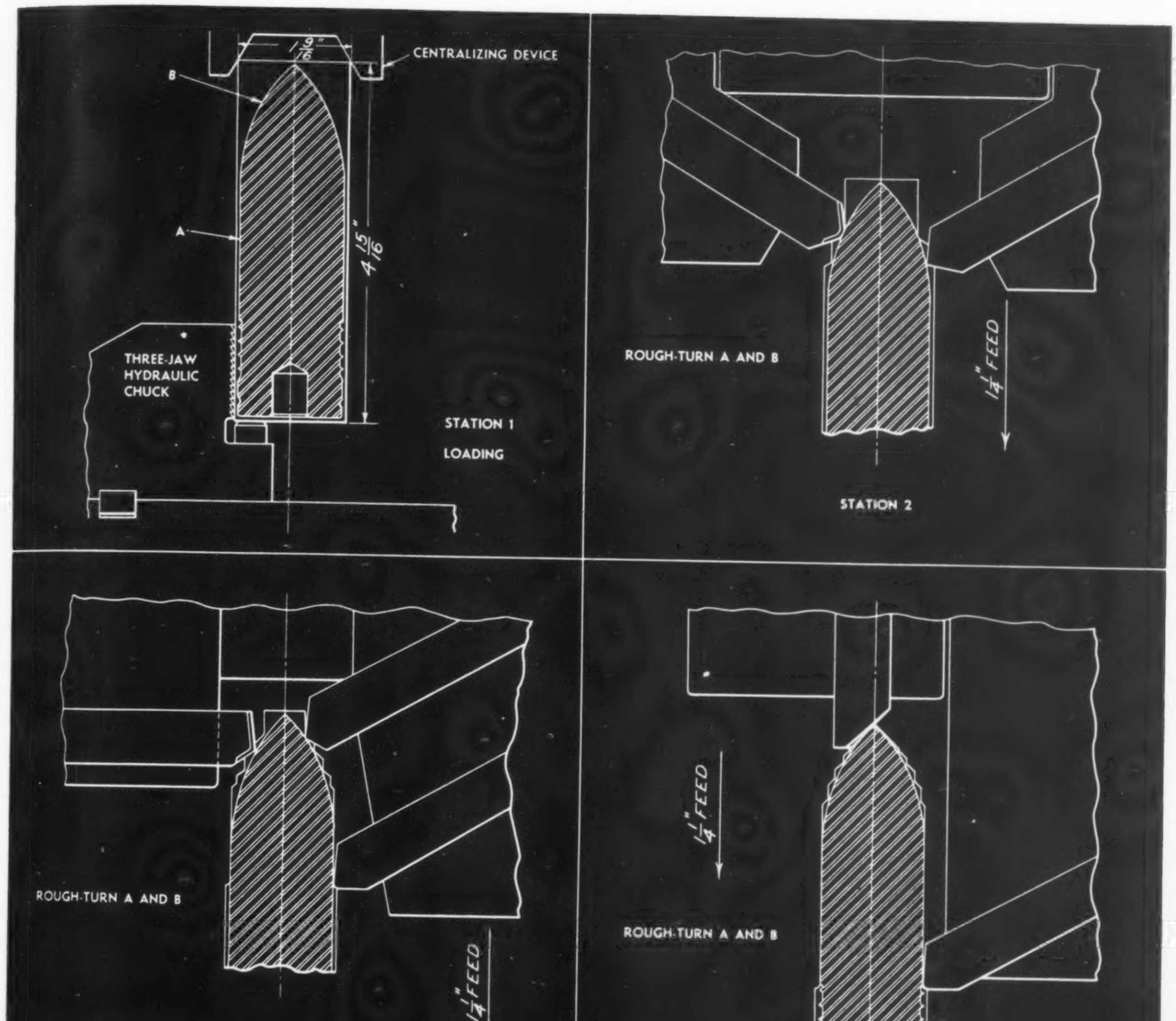


Fig. 3. Machining Operations on Nose Section of 37-millimeter Armor-piercing Shot

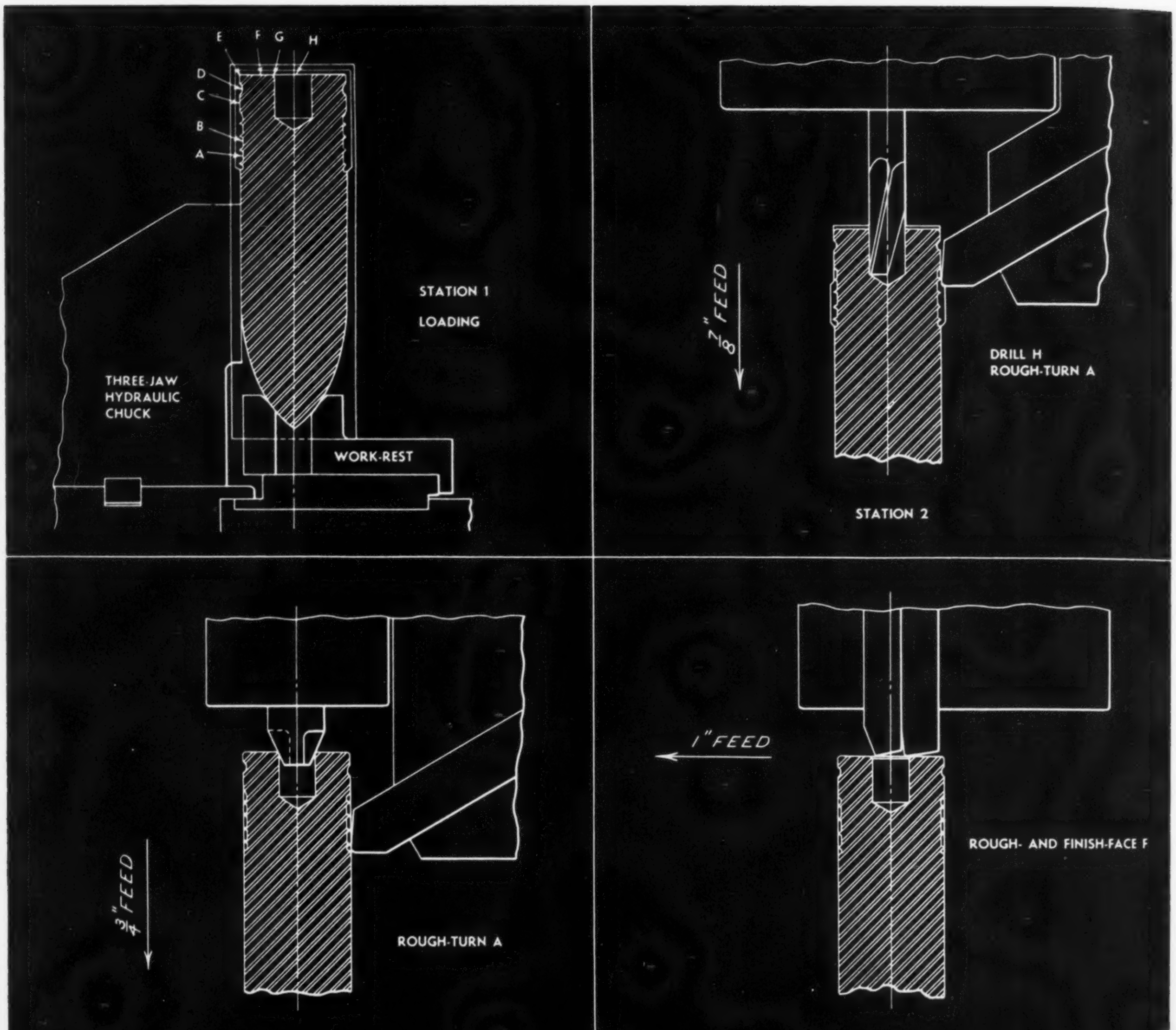


Fig. 4. Machining Operations on Base Section of 37-millimeter Armor-piercing Shot

As shown in Fig. 3, steel bar stock 1 9/16 inches in diameter and 4 15/16 inches long is loaded into a hydraulically operated chuck at the first station of the machine. A spring retracting hand-centering device, shown at the extreme right in Fig. 1, serves to hold the work-piece in position until it is firmly gripped by the chuck jaws.

Vertical roughing cuts are taken at Station 2 in the first operation to narrow down the nose end of the work-piece. A plain vertical head is used, with a downward feed of 0.0132 inch per revolution for a distance of 1 1/4 inches. The work rotates at 122 R.P.M. The shape of the piece at the end of this operation is shown in the right foreground of Fig. 1.

At Station 3, two vertical roughing cuts are taken at the top of the piece, thus forming two additional steps to more closely approximate the final nose taper, and at the same time, a roughing cut is taken part way down the side of the piece. The speed, feed, and distance of travel are the same as at Station 2. The appearance of the piece at the end of this operation is as shown in the left foreground of Fig. 1.

A form cutter is used at Station 4, to establish the contour at the end of the nose, while a second tool continues the roughing cut down the side of the work-piece that was begun at Station 3. A compound head is employed, and is used at this station in the second chucking to effect a horizontal feeding movement. The speed, feed, and distance of travel are the same as before. At the completion of this operation, the piece appears as shown in the right foreground of Fig. 2.

At Station 5, the full contour of the nose is rough-formed by two tools, while the point of the nose is slightly rounded by a third. The downward feed for approach is 0.0082 inch, and for cutting, 0.0041 inch per revolution for a total distance of travel of 1/2 inch. The work-piece rotates at 100 R.P.M. A universal head is employed, and is used at this station for horizontal feeding movement in the second chucking. The appearance of the piece after this operation is shown in the left foreground of Fig. 2.

Next, the nose and side are finish-turned at Station 6, using a speed of 280 R.P.M. and a downward feed of 0.0102 inch per revolution for a distance of 2 1/4 inches. A compound head is employed for traversing the single-point tool used to finish-cut the ogive. The appearance of

Fig. 5. View of Sixth Station of Mult-Au-Matic, where the Nose Section of the Shot is Completed. A Piece with Finished Nose Section is Seen in the Machine

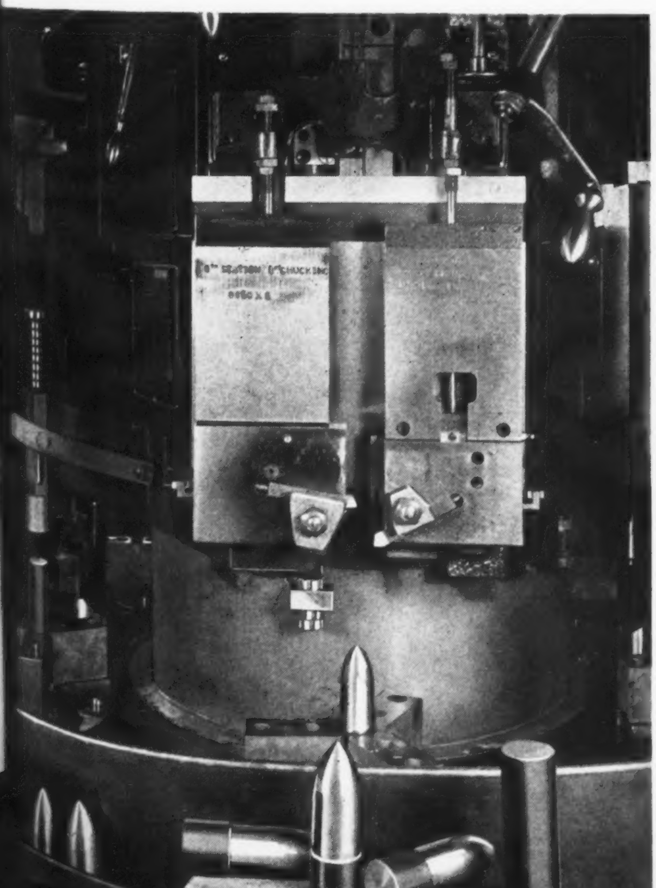
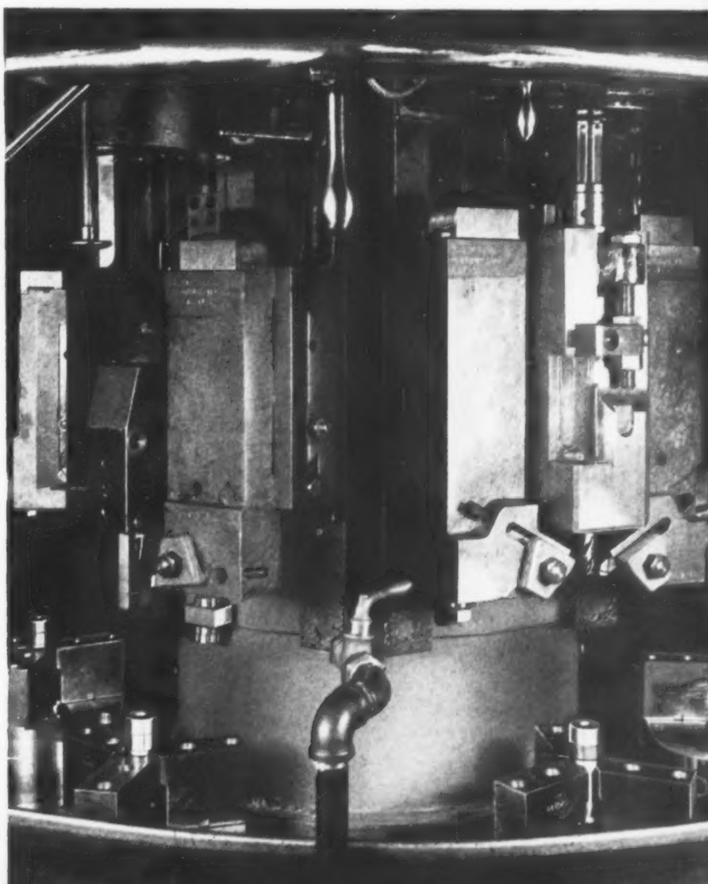


Fig. 6. Tooling for Machining Base End of 37-millimeter Shot. Work is Shown from Right to Left after Operations at Second, Third, and Fourth Stations



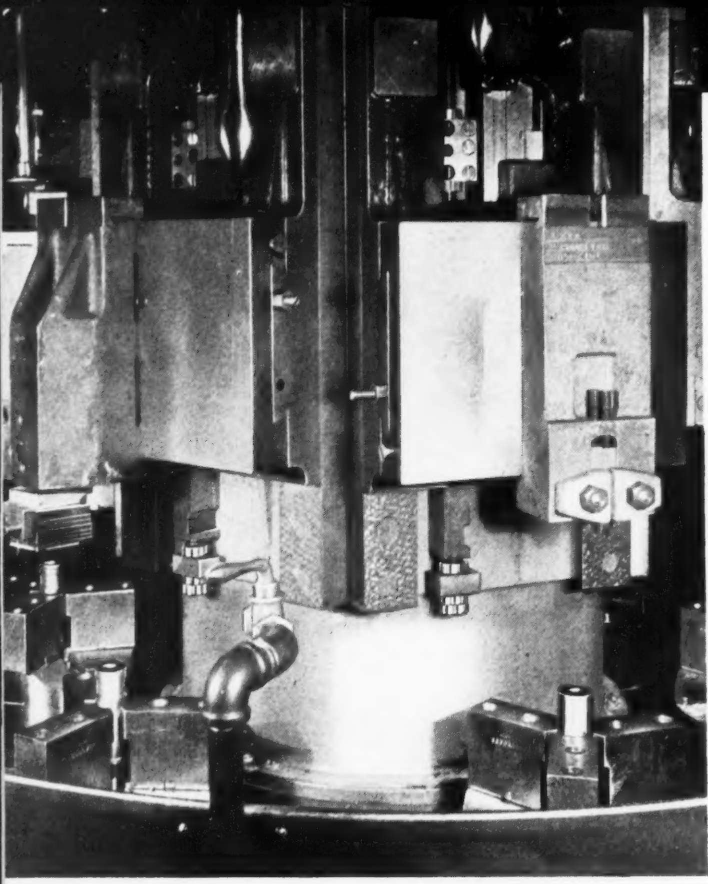


Fig. 7. Another View of Tooling Equipment for Machining Base End of Shot. From Right to Left Work is Seen after Operations at Fourth, Fifth, and Sixth Stations

the finished nose is shown in Fig. 5. Based on 85 per cent efficiency, a minimum production of 80 pieces per hour was estimated. In actual use, a higher average production was obtained.

The work-piece is now removed for rechucking to permit machining the base end. At Station 1, the piece is inserted nose downward into a work-rest, as shown in Fig. 4. Soft jaws are used for clamping.

Then the base is drilled to depth at Station 2, and a roughing cut is taken part way down the side. The work is rotated at 135 R.P.M., while the drill is rotated at 350 R.P.M. in the opposite direction and fed downward at the rate of 0.005 inch per revolution. The side-cutting tool is given a downward feed of 0.0146 inch per revolution for a distance of 7/8 inch. The piece is now as shown in the right foreground of Fig. 6.

The hole at the base of the work-piece is next chamfered at Station 3, and the roughing cut begun at Station 2 is continued to remove the remaining excess stock. The work is rotated at 135 R.P.M., and a downward feed of 0.0125 inch per revolution is used for a distance of 3/4 inch. The appearance of the piece at the end of this operation may be seen in the left foreground of Fig. 6.

At Station 4, the end of the piece is rough- and finish-faced, using two tools. A horizontal feed of 0.0102 inch per revolution for a distance of 1 inch and a speed of 219 R.P.M. are used.

The rifling band groove and the cartridge-case groove are formed at Station 5. A horizontal feed of 0.0086 inch for approach, and 0.0043 inch per revolution for cutting is used, together with a speed of 100 R.P.M. The work now appears as shown in the left foreground of Fig. 7.

At the sixth and final station, the edge of the base is rounded slightly with a form cutter, and the remaining excess stock between the cartridge-case groove and the rifling band groove is removed, using a downward feed of 0.0102 inch per revolution for a distance of 11/16 inch and a speed of 150 R.P.M. Based on 85 per cent efficiency, a minimum production of 51 pieces per hour was estimated.

Lockheed Sheds "Tears" for the Axis

Manufacturing Processes Employed in Turning Out Auxiliary Gasoline Tanks for Fighter Planes

By MARLIN W. COKER, Manufacturing Engineer
Lockheed Aircraft Corporation
Burbank, Calif.

STREAMLINE, laminar-flow drop tanks designed to greatly increase the gasoline carrying capacity and flying range of Lockheed Lightning P-38's, Vega Ventura bombers, and other American aircraft are being turned out by one of the branch plants of the Lockheed Aircraft Corporation near Los Angeles at the rate of one tank every four and a half minutes. These drop tanks enable our fast fighting planes to carry aerial warfare right into the "back yard" of the enemy and return to their bases without refuelling. The tanks are assembled on a continuous conveyor line, which was in operation ninety days after the order for the drop tanks had been placed by the United States Army Air Forces, although at that time there was not even a tank on Lockheed drawing boards. The high output obtained from this conveyor line has primarily been made possible through the use of ingenious welding equipment.

Each tank weighs 90 pounds empty and 1000 pounds when filled with 165 gallons of gasoline. Two of these tanks, clamped beneath the wings of a Lockheed Lightning, as shown in the heading illustration, will approximately double the normal flying range of planes of this type and enable them to be flown to any fighting front directly from the Burbank factory. The aerodynamic problems were overcome so skillfully that the two auxiliary tanks, when full, reduce the speed of these airplanes only 4 per cent at top speed.

WAR PRODUCTION

Fig. 1. (Left) Special Series Welder Designed for Use on Double-contour Surfaces. Operation Shown is Seam-welding Adapter Assembly of Filler Well to Left-hand Skin of the Fuel Tank

Fig. 2. (Below) Fabricating Drop Fuel Tanks for Lockheed Lightning and Vega Ventura Planes at the Rate of One Every Four and a Half Minutes

According to Army specifications, the cost of the tanks would have to be much less than that of an aluminum tank being manufactured by a nearby sub-contractor, the first two thousand of which had cost the Government $678 apiece. In addition, it was specified that these tanks should not be made of a critical material, and would have to be adaptable to a much higher rate of production. To meet these requirements, a tank was designed which is made up of two half shells of S A E No. 1010 body steel, 0.024 inch thick. The completed tank sells for less than $100.

All detail parts used in the fabrication of these tanks are supplied by sub-contractors, and are assembled in a department of the Lockheed plant, as shown in Fig. 2. The first operation consists of oxy-acetylene welding a threaded sump plug to a flange that extends around a hole pierced through the left-hand skin or shell. This hole is somewhat smaller in diameter than the plug, and for this reason a special clamp is used to seat the plug firmly in the hole. The welding operation is performed around the top edge of the flange and one end of the sump plug.

The next operation consists of welding a filler-well adapter assembly to the left-hand skin by employing the special series welding machine

seen in Fig. 1. This machine is similar to those commonly used in projectile manufacturing plants for welding steel disks to the base end of shells. It has two roller electrodes which superimpose spot welds on each other to make an airtight seam around the adapter flange.

The operation on the drop tanks is, however, somewhat unusual in that the weld is made on a surface of double contour, which has a rise of 3/4 inch around an arc of 90 degrees. The filler-well adapter is placed on the bottom, or grounding, electrode and the tank shell on top of the adapter, so that the roller electrodes run on the tank itself.

The welding head is operated vertically by two air cylinders. These cylinders and the welding units are electrically insulated from each other, and are mounted on a casting which rotates on a hollow shaft mounted vertically, so that the roller electrodes can be run in a circular path on the work. Water-cooled welding cables which connect the two sides of the transformer secondary to the copper shaft housing pass down through the hollow shaft. The welding head is operated in opposite directions on consecutive pieces to reduce wear of the cables.

The welding circuit is closed when the roller electrodes make contact with the tank skin. Since the welding current flows through the sheets at two points, two welds are made simultaneously, and the 360 degrees of welding is completed with approximately 185 degrees of rotation of the welding head.

After this operation has been completed, seven bulkheads are welded to both the left- and right-hand skins. This is accomplished in two Lockheed designed semi-automatic welding machines, one of which welds three bulkheads, and the other the remaining four. One of these machines is illustrated in Fig. 3. When the half shells are placed in these machines, they are supported beneath the bulkhead stations by copper-alloy electrode bars of curved design, which are machined to fit the outside contour of the pressed-steel tank section. The bulkheads are located on overhead semicircular holders attached to a hinged cover of the fixture, and the bulkhead holders are also hinged on one side to facilitate loading and unloading.

Welding is performed by roller electrodes in each bulkhead station. The electrodes are also mounted on the hinged fixture cover and revolve

Fig. 3. Ingenious Fixture for Welding Seven Bulkheads to Fuel Tank. Two Semi-automatic Welding Machines are Employed, One Fastening the Three Bulkheads Shown, and the Other the Remaining Four

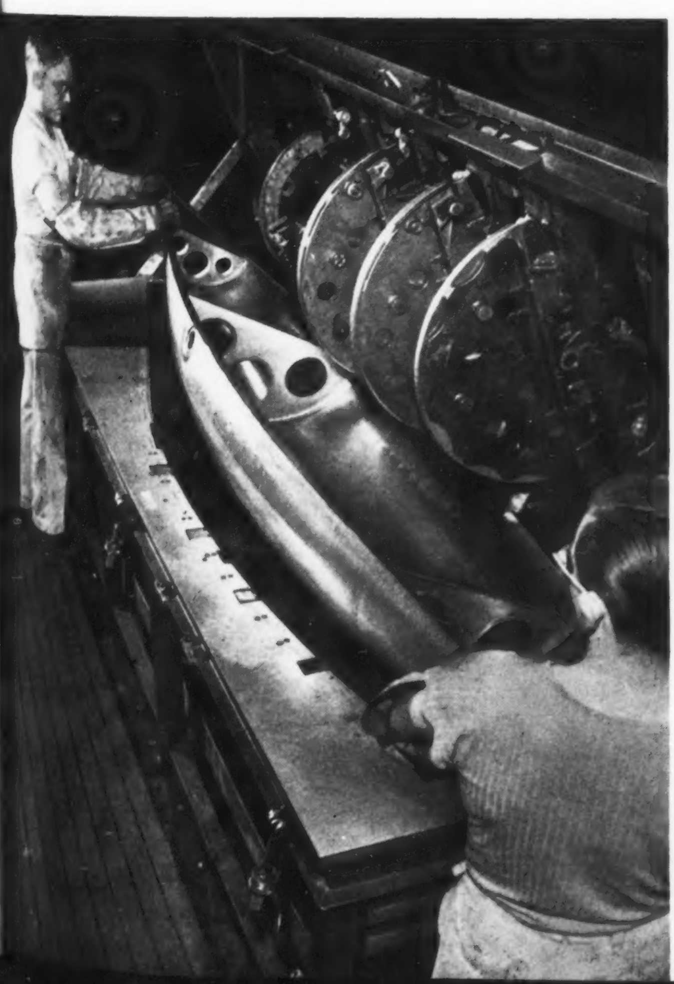


Fig. 4. Operator Follows along with Moving Conveyor while He Welds a Keelson Angle to Skin and Bulkheads of Fuel Tank. Other Small Parts are Similarly Welded while Conveyor Line is in Motion

Fig. 5. Portable Seam-welder Employed for Welding Two Halves of a Pan-shaped Housing to Halves of Tank

about the longitudinal axis of the tank. Each welding unit consists of an electrode roller and shaft, shaft housing, guide casting, air cylinder, 1/12-H.P. electric motor, a reduction-gear box, and the necessary gear train for driving the electrode shaft. The sequence panel and welding transformer are located outside the jig itself.

The welding operation is controlled by means of a Westinghouse non-synchronous pulsation-weld timer panel and a Weld-O-Trol electronic contactor. These timers were modified slightly to provide the desired sequence of operations. The spot-welds on the two center bulkheads have a center spacing of 1/2 inch, but on the other bulkheads the welds are spaced 3/4 inch apart. The actual welding time of each machine is one minute, another minute being consumed in loading and unloading.

The half shells are next placed on a moving conveyor which is provided with cradles for carrying one tank each. The complete conveyor has thirty-six cradles and is 475 feet in length. Flanged gussets and other parts for holding the tank to the airplane are located on the bulkheads by means of fixtures constructed of pipe, as seen on the tank section in Fig. 4.

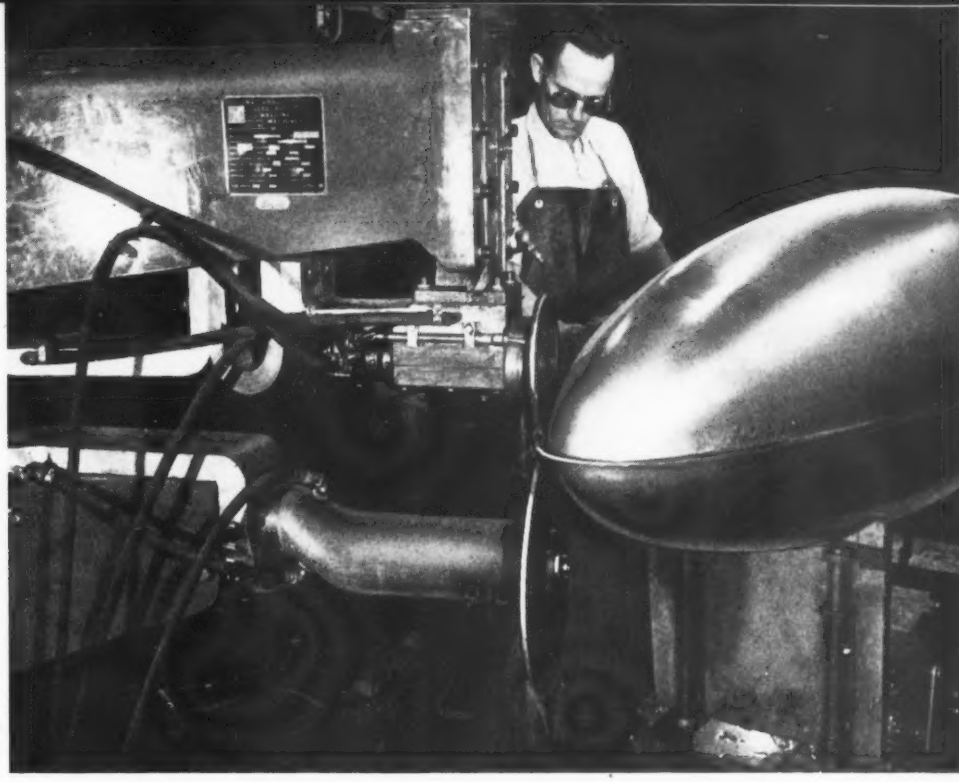
These detail parts are spot-welded to the shells by employing Acme gun type spot-welders that run on monorails. The arrangement enables each operator to follow the tank section along the conveyor line until his particular

Fig. 6. Two Half Shells Ready for Assembly to Form 165-gallon Drop Fuel Tank. Two Such Tanks will Virtually Double the Range of the Lockheed Lightning P-38 Fighter

Fig. 7. (Right) Seam-welding Two Halves of Fuel Tank together at Rate of 60 Inches per Minute. Operation is Completed in 4 Minutes

Fig. 8. (Below Left) When This Table is Rotated, 30 Gallons of Zinc-chromate Primer are Slushed about inside the Tank to Provide a Protective Coating for the Inner Skin and Bulkheads

Fig. 9. (Below Right) Hot Cleaning Bath Removes All Grease and Dirt from Fuel Tank preparatory to Painting



welding job has been finished. The electrodes on this gun welder are positioned at right angles to each other to prevent interference from some of the tank details. Fuel and vent pipe lines are next tack-welded by means of oxy-acetylene torches, after which a number of structural members are attached by the use of gun type spot-welders.

The two halves of a pan-shaped housing that encloses the device for attaching the tank to a plane are then seam-welded to the tank halves by means of the portable welding machine shown in Fig. 5, which is suspended from a counterbalance of 175 pounds capacity. Welding is done while the half tank is in motion along the conveyor line.

Various other small parts are now put in place at different welding stations, after which hooks for attaching the tank to a plane are bolted in place in the tank by applying power-driven socket wrenches. At this point, the tank halves appear as shown in Fig. 6.

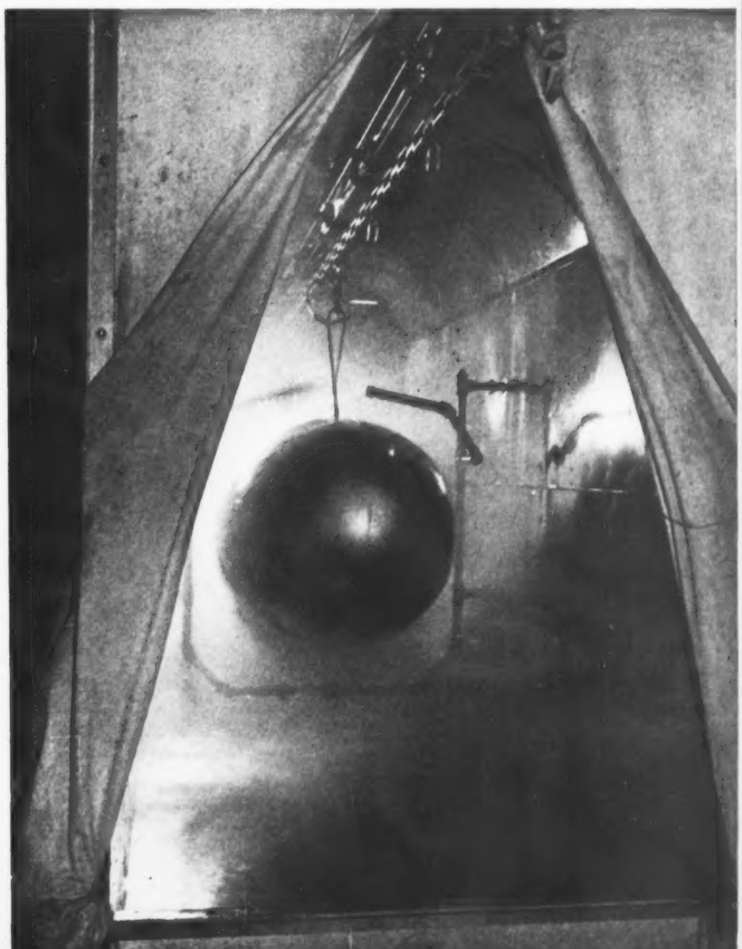


Fig. 10. While being Carried through a Paint Booth on a Conveyor the Tank is Sprayed with Two Primer Coats and a Coat of Camouflage

There is then a check-up to make certain that there are no loose parts, after which the right- and left-hand tank shells are mated and clamped together. Punched holes in the flange are used to insure correct assembly. The tank halves are next tack-welded together by the use of a gun type spot-welder.

Then the tank is taken off the assembly line, placed in a special cradle, and transferred to an adjacent National electric welding machine, shown in Fig. 7. This equipment is employed for welding the two halves completely together. In this operation, the roller electrodes actually pull the work along the machine, the cradle being provided with ball-bearing casters that facilitate this movement and thus reduce fatigue of the operator. He merely guides the tank along the electrodes. Again the operation consists of superimposing spot-welds on each other to obtain a continuous seam. The upper electrode is operated up and down by means of an air cylinder, while the lower electrode is stationary. This welding operation is performed at the rate of 60 inches a minute, or a total of 4 minutes per tank.

Excess metal on the flange is now trimmed off by using a portable electric Unishear. A tail plug flange is then welded in place by using an oxy-acetylene torch in the same manner in which the sump plug was welded.

Then the tank is placed back on the conveyor and air is pumped into it to a maximum pressure of 5 pounds per square inch. Soapy water is applied on the outside, so that any leakage will

Fig. 11. Affixing Various Decalcomanias and Anti-sabotage Seals to Fuel Tanks and Crating for Shipment to Fighting Fronts

be indicated by the appearance of a soap bubble. Leaks are eliminated by oxy-acetylene welding. A special gaging fixture is next applied for checking the dimensions between the suspension hooks, the hooks being filed by hand to fit the gage.

The tanks now arrive at the slushing table seen in Fig. 8, on which they are loaded at an angle with respect to the axis about which the table revolves. Thirty gallons of non-inflammable zinc-chromate primer is then poured into each tank. When the table is rotated, the primer is thrown from end to end of the tanks and distribution of the primer to every portion of the inside is insured. The table is revolved for 1 1/2 minutes in each direction. At the end of this operation, the primer is drained from the tanks, and they are loaded on a dolly for drying with hot air supplied through a hose.

Next each tank is given a final pressure test to detect any leaks that may have escaped notice in the previous test. Then a permanent tail plug is screwed into place and the tank is placed on a second conveyor, from which it is suspended by a bail hung from the conveyor, which is fastened to the hooks by means of which the tank is attached to a plane. The second conveyor carries the tanks successively through a hot Turco bath, a water rinse, a drying oven, and a paint booth. Two primer coats and a final camouflage paint are sprayed on. Fig. 9 shows a tank in the hot bath unit, and Fig. 10 a view of one of the painting stations.

The same conveyor then carries the tanks up through a window and out into a shipping building, where it goes high over railroad tracks to a platform where a girl applies decalcomanias that give the manufacturer's name, the capacity of the tank, and other information. Anti-sabotage seals are also placed over all openings at this station.

There is now a final visual inspection for appearance and defects, after which the tanks are carried outdoors to a station where a protective coating of Paralketone is applied by a spray gun. The tanks are then returned to the shipping building for crating, ready for transportation overseas. Fig. 11 shows a view of the station where the decalcomanias are applied, and of the crating floor.

Relieving Strains in Castings

OWING to the speed with which machine tools must be built and delivered under wartime conditions, it is no longer possible to use the old method of relieving strains in castings by storing them in the shop yard for several months. Instead, the stresses set up by the uneven cooling which takes place in castings having variations in the thicknesses of walls and sections are relieved in annealing furnaces.

A modern installation of this kind was recently built in the plant of the Landis Tool Co., Waynesboro, Pa. In this installation, a large flat steel car, which is loaded in the foundry, is pushed into the annealing furnace by means of electric power. The furnace is housed in a separate building, but an enclosed passageway connects it with the foundry. As the car enters the furnace, the heating space is automatically sealed along the sides of the floor of the flat car by an ingenious arrangement of having the edge of the car pass into a trough of sand. The door to the furnace is lowered and is properly sealed in the front to retain the heat.

Oil-fired burners with automatic controls raise the temperature in the furnace to from 700 to 950 degrees. This temperature is maintained for about six hours, so that every part of the castings will be raised to that temperature. Then the oil is turned off, and the car with the castings is left sealed in the furnace. In this way, the castings cool slowly with the furnace interior in from twenty-four to forty-eight hours. The slow cooling prevents any cooling strains from developing, since every part of the casting, whether a thin rib or a heavy body of metal, cools off simultaneously.

When annealed in this way, the castings maintain their shape and alignment permanently after machining. The uniformity of the castings also makes it possible to speed up many machining operations.

* * *

Salvaging Worn Surface Plates

A new method of salvaging worn surface plates has been developed by the Lincoln Park Tool & Gage Co., 1719 Ferris Ave., Lincoln Park, Mich. The process consists of refinishing the plate, hard chromium-plating it, and then lapping. The chromium-plating produces a surface that wears much longer than the ordinary surface plate material. The surface is not only harder, but also smoother, and is highly resistant to corrosion. At present, the salvaging of surface plates is limited to sizes up to 18 by 24 inches.

Editorial Comment

The results obtained through the economic methods applied in the United States during the great development era of the past hundred years prove that our economic methods will provide a higher standard of living than any other system has ever provided elsewhere. The name—the free enterprise system—implies much more than the words express, because wherever there is free enterprise, there must be all other freedoms as well; and it is to preserve these freedoms that this war is being fought.

After the war, if we are to preserve the benefits of the free enterprise system, we must eliminate many things that within recent years have tended to destroy free enterprise.

The Preservation of Freedom Depends on Free Enterprise

We must fight vigorously against the influence of "pressure groups," whether in business, agricultural, or labor circles. The pressure group wants what it wants, irrespective of what happens to the rest of the nation. This is in evidence even now—during the war.

As long as there are pressure groups, we do not have a united nation working and fighting for a single aim. No matter what we think of the evil forces that are trying to destroy democratic government, we must admit that much of the success of the Axis nations is due to the fact that they have a unity of purpose, even though the purpose is evil. What we need also is unity of purpose—but our purpose should be that of preserving the time-honored freedoms under which this country has grown great.

In tooling up for war work, automotive engineers have often found that much war equipment is not designed for mass production. Frequently, parts are designed so that they can be produced only by slow tool-room methods. New designs of such parts have often been submitted by the production men to simplify the manufacturing processes.

For example, a part formerly made from a solid forging, and finished all over, is now being made from heavy steel stampings and finished only where it fits other parts in the assembly. This change reduced the number of machining operations from twenty-nine to fifteen, and released one-third of the machine tools for other work. A sizable reduction in cost to the Government was obtained, in addition to a saving of 2500 pounds of steel per month.

In another case, a part was originally made from a solid alloy-steel forging. The automobile engineer's experience suggested a simple design made from two parts welded together.

Automotive Engineers Adapt Armament Parts to Mass Production

This saved three hours' machining time per piece and 25 tons of alloy steel monthly. Obviously, the cost was considerably reduced. In this way, engineers engaged in production work have saved the Government great amounts of material, time, and money.

Millions of workers today are performing operations on perhaps a single piece to be used in connection with some war equipment. Day in and day out they produce the same parts, acquiring skill and speed in doing this work; but they have little or no knowledge of the real purpose of the part on which they are working and do not recognize its importance.

A Way to Stimulate Workers' Interest in War Production

Believing that the man or woman in a war factory whose work is confined to only one or a few operations would be stirred to greater effort by having an opportunity to see the completed product and understand its use, the Thordarson Electric Mfg. Co., Chicago, Ill., decided that something ought to be done about this. This company makes an unusual type of radio receiving apparatus. Demonstrations are being staged so that the workers may see the actual application of the equipment and understand how the part on which they are working fits into the completed assembly. The importance of the equipment for saving lives in the present conflict is also emphasized. The results have been marked. The workers have put forth greater effort, and absences have been reduced.

How to Secure Fine Surfaces by Grinding

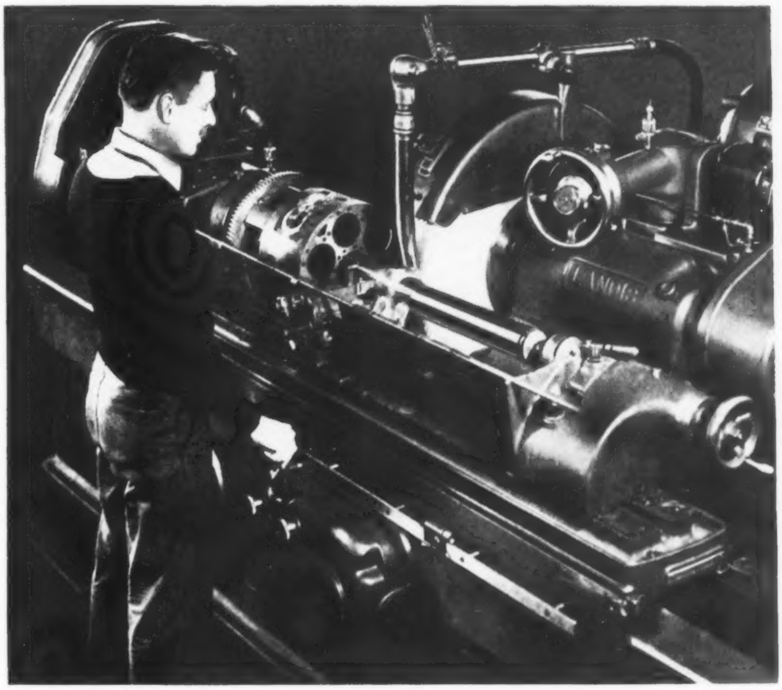


Fig. 1. Grinding a Shaft to a Tolerance of 0.0003 Inch in Diameter and 0.00015 Inch in Roundness and Parallelism over its 26-inch Length. Surface Roughness Must not Exceed 4 Micro-inches

Second of a Series of Articles Describing the Factors Governing Fine Surface Quality and the Means by which it Can be Obtained

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IN the first article of this series, published in April MACHINERY, the general factors affecting fine surface quality, and the classes of work for which such quality is needed, were discussed. This article will take up some of the points in grinding machine operation that should be watched if fine surface quality is to be obtained.

The fact that exceedingly fine surface quality can be obtained by grinding without any subsequent finishing operations is not known widely enough. Ignorance of this fact is probably responsible for many shops resorting to unnecessarily slow and costly operations, in addition to grinding, where fine surface quality is called for.

A Case Illustrating the Possibilities of Grinding

Thus, for example, a company whose peacetime product had not required extremely fine surface quality received a prime contract for an assembly in which one of the parts had to be given a finish of 2 micro-inches r.m.s. While otherwise well equipped, this company's cylindrical grinding machines were old, poorly maintained, and on the whole, under-powered, although they had been adequate for the needs of its regular production.

To obtain the required surface quality of 2 micro-inches r.m.s. with the equipment at hand, it was found necessary to employ a lapping operation after the finish-grinding. This requirement made production so slow, however, that it was finally decided to sub-contract the part.

As too often happens, the surface was specified in the sub-contract not by r.m.s., nor by means of a sample, but by kind of operation. Having no experience with what can be done with a modern, well maintained grinding machine in the way of fine grinding, the company engineers specified a lapped surface.

The sub-contractor objected to this specification when he subsequently learned that the requirement was a surface of 2 micro-inches r.m.s. He turned out some sample pieces using only rough- and finish-grinding—and to the prime contractor's amazement, they were within the requirement. The sub-contractor's grinding machines were modern and well maintained, and his skilled operators had no difficulty in securing such a surface by grinding alone.

As a matter of fact, if grinding machines are kept in the best possible condition, surfaces of an even better quality than 2 micro-inches can be secured without resorting to lapping or honing. It is possible to rough- and finish-grind plug gages to a surface quality of from 0.4 to 0.7 micro-inch r.m.s. while holding the dimensional accuracy to within 0.0005 to 0.000005 inch

tolerance for diameter, and to 0.00005 inch tolerance or less for roundness and straightness. Of course, this is not done on what could be called a production basis.

Incidentally, it is to be noted that anything remotely approaching such dimensional accuracy in grinding is possible only on a machine that is in the best of condition. Also, it is usually necessary to employ wheels of special abrasive and bond characteristics, as will be discussed in a subsequent article. However, the average part can be finish-ground to 4 to 5 micro-inches r.m.s. on a high-production basis.

Take as an example the assembly shown in Fig. 1. The shaft that is being ground must be accurate to within 0.0003 inch in diameter, and round and parallel over its entire 26-inch length to within 0.00015 inch. Finally, the surface must not have a roughness of more than 4 micro-inches. The operation is accomplished on a Landis plain hydraulic 14-inch by 48-inch cylindrical grinder by rough- and finish-grinding. About 0.001 inch of stock is removed in the finish-grinding. Needless to say, the machine is of modern design, with ample power, and is kept in the best of condition.

In Fig. 2 a special micrometer barrel is being finish-ground on a plain hydraulic grinding machine. The tolerance of 0.0002 inch is being bettered regularly.

In fine grinding, not only are dimensional inaccuracy and surface roughness ruled out, but also such surface defects as burns, checks, flats, scratches, and chatter marks. When these difficulties occur, one or more of the following conditions may be the cause:

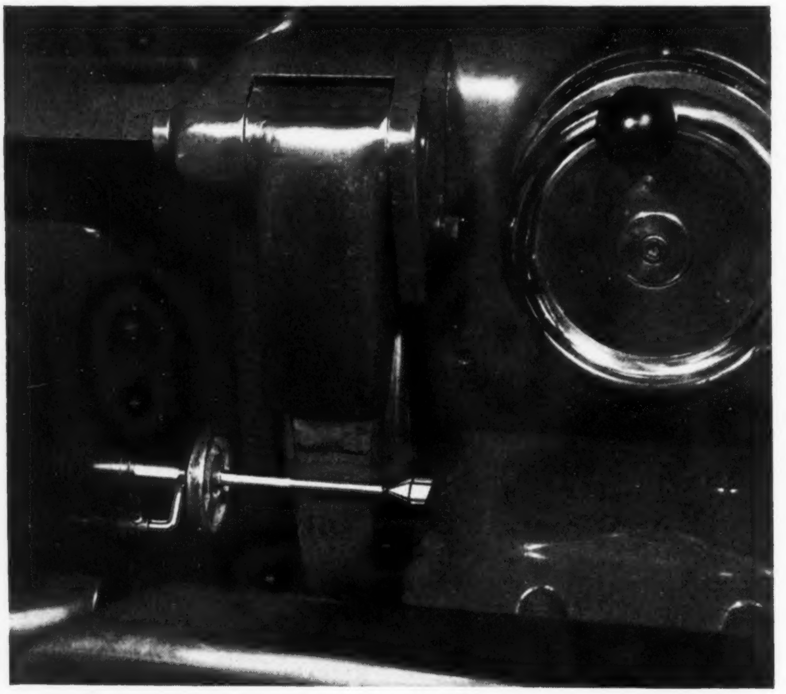


Fig. 2. Finish-grinding a Special Micrometer Barrel on a Plain Hydraulic Grinding Machine within a Tolerance of 0.0002 Inch

Factors Affecting Grinding Machine Operation

1. *Inadequate Power*—Unless adequate power is delivered at the wheel, the grinding may be uneven, the work burned, or the wheel loaded. Burning is indicated by discoloration. A loaded wheel shows metal lodged on the abrasive grains or in the pores. It will not cut properly, will burn the work, and cause chatter marks.

Often burning and loading are attributed to using too hard a wheel or the wrong coolant. Either of these may be the cause, but before changing wheels it will pay to check the condition of the machine, especially the amount of power being delivered to the wheel. The trouble may be that the machine was under-powered in the first place. However, the same difficulty may appear in an adequately powered machine as the result of friction in the machine, too low a line voltage, a slipping belt, wheel slippage due to faulty mounting, or other factors that cause variation in the wheel speed.

2. *Wheel-Spindle in Poor Condition*—The wheel-spindle might be called the heart of a grinding machine. If its condition is not practically perfect, the work is likely to be burned, scored, or blemished by chatter marks. The spindle may have worn or loose bearings, or it may be out of round. The symptoms of worn or loose spindle bearings are short, close, evenly spaced chatter marks, and sometimes isolated deep scratches. The indications of a spindle being out of round are longer and more widely spaced chatter marks.

The condition of the spindle determines to some extent the grit size, bond type, and grade of the wheel that can be used. If the spindle is of high quality and is running properly in the correct type of bearings, exactly the right wheel for any specific job of fine grinding can be used. If the spindle wabbles or vibrates, however, a harder, and usually an organic, grinding wheel must be used. Even with the proper type of wheel, a machine with a spindle that is not in good running condition will be suited only to comparatively rough work.

The spindle bearings should preferably be of high-grade babbitt, as this gives a closer running

fit when heated. Incidentally, when doing a job of fine grinding, it is advisable to give the machine a preliminary run to heat up the bearings and provide a closer bearing clearance.

In use, the spindle of a grinding machine is likely to become out of round and ridged, and the bearings worn to such an extent that they have high and low spots. The old method of reconditioning the spindle is to grind it and scrape down the high spots of the bearings. This is a slow process which consumes production time. In one shop, the average "down" time for such an operation was between fifty and sixty hours.

Then, again, this method does not give the best results. Few workmen can scrape a bearing so well that there will be as much as 20 per cent of the bearing area carrying the load of a well reconditioned spindle. The result is rapid wear of both spindle and bearing and frequent readjustments to take up the looseness caused by such wear. Consequently, precision work is impossible during the wearing-in period.

Reconditioning Spindles by Lapping

The modern way to recondition grinding machine spindles is to lap in the spindle to its bearings after first regrinding the spindle, if it has become badly out of round by neglect. If the spindle is only slightly out of round, lapping will rectify the condition. Of course, it will be necessary to scrape the bearings if the spindle assembly has become out of alignment.

The method of lapping in a spindle to its bearings is as follows:

A special lapping compound consisting of 220-grit aluminum-oxide abrasive in a paste vehicle is fed to the parts through the oil-holes, or it may be "painted" directly on the parts. The bearings are then tightened until there is a slight drag when the spindle is rotated by hand. In tightening the bearings, care should be taken to avoid pressure great enough to crush the abrasive grains. Since the lapping compound used is especially designed for this purpose, there is no danger of its impregnating either the spindle or the bearings.

The spindle is rotated either by hand or by means of a light belt which is maintained just tight enough to rotate the spindle. In addition, the spindle is oscillated in a lateral direction to prevent grooving. Machine oil is applied to the bearing surfaces often enough to replace that taken up by the cuttings.

The lapping operation is continued until the surfaces are dark gray. The bearing should be adjusted often enough to maintain a slight drag as the surfaces are lapped down.

The spindle and bearings are then cleaned, and the operation is repeated with a 600-grit compound of the same type as previously used until the parts take on a lighter gray color. From then on, no more compound is added, but machine oil in larger and larger amounts is used until there is practically no more compound left. The bearing is then readjusted to give a light drag, and is run for five or ten minutes with nothing but oil. After this, the parts are cleaned with a dry rag and reassembled. The oil clearance should now be correct.

If the spindle journal is tapered, it should be raised from the bearings occasionally during the lapping operation to allow compound to flow to the tapered end. An hour is a fair average time for reconditioning bearings and spindle by this method. That is the time now required by a shop that formerly took fifty to sixty hours. The operation is done right at the machine, and so eliminates the need for moving the machine or any of the parts to the maintenance department.

In one shop, lapped-in spindles and bearings frequently run as long as seven months before it becomes necessary to take up the wear, and with reasonable care, no further reconditioning is needed for more than two years. The reason for this is that no running-in is required when the machine is in production. Permanent running surfaces are formed quickly and completely by the lapping operation. So close a running fit is secured that the spindle will be free from flutter, the work will not develop defects from this cause, and extremely close tolerances can be maintained.

Correction of Vibration

3. *Vibration*—If vibration occurs, either in the machine or in the building, chatter marks will result. Those caused by the machine are regularly spaced, and may result from misalignment, loose couplings, or the motor and spindle being out of balance. Building vibration causes chatter marks that are spaced synchronously with the building vibration. If the machine is a heavy one, this difficulty can usually be corrected only by providing the machine with a separate foundation, which is entirely independent of the floor, or by moving the machine to another location. With a light machine, vibration dampers are useful, although sometimes the trouble can be corrected by loosening or tightening the anchor bolts.

4. *Belts of Uneven Thickness or Pliability*—This condition will cause chatter marks that are widely spaced and regular. Chatter marks that are of a single definite pattern of any width, and are either regularly or irregularly spaced, are often caused by a metal belt lacing. The best practice is to employ endless belts when fine grinding is being done.

5. *Loose or Out-of-Balance Idler Pulleys*—When idler pulleys are loose or out of balance, regular, widely spaced marks similar to those caused by an uneven belt will appear. The pulleys should be balanced, fitted with new bushings, and preferably lapped to the shafts on which they are to run.

6. *Backlash in Drive Gears*—This will cause chatter marks that are long and widely spaced. They may vary around the body of the work, but otherwise will follow a regular pattern. In such cases, the old gears should be replaced or a change made to belt drive.

7. *Loose Pulley on the Spindle*—When a pulley on the spindle is loose, the result will be marks similar to those due to belt lacing, except that they will be more frequent.

8. *Worn Traverse Drive Parts*—Such a condition is indicated by isolated deep scratches. The badly worn parts should be replaced, and any play taken up.

9. *Misalignment of Headstock and Tailstock or of Wheel-Head and Work*—Misalignment of these parts will cause spiral traverse marks of the same lead as the rate of traverse.

10. *Miscellaneous Causes*—Inaccuracies in the work may be the result of one or more causes. If the work is out of round, the trouble may be that there is uneven pressure on the driving points. In that case, the points should be placed equidistant from the work axis, and if necessary, cushions used between the points and the work. It may be that the driving points are not parallel with the axis of the work, in which case the points and faceplate should be trued. If the work is out of parallel, or tapered, the setting of the headstock and tailstock may be faulty, the ways may be badly worn, or the spindle bearings may need tightening.

In this article, only those troubles that preclude fine grinding and that are due to faulty machines have been listed, and remedies prescribed. Many difficulties may be due to other causes, such as using an incorrect grinding wheel or faulty wheel manipulation. These will be discussed in subsequent articles.

New Officers of the American Society of Tool Engineers

THE American Society of Tool Engineers elected the following new officers at the annual meeting of the Society, recently held in Milwaukee: President, Ray H. Morris, vice-president of Hardinge Brothers, Inc., Elmira, N. Y.; first vice-president, Douglas D. Burnside, superintendent of the American Stove Co.; and second vice-president, C. W. Briner, assistant to the president of the Pipe Machinery Co. Earl Johnson, of the Firth-Sterling Steel Co., was elected to serve as the Society's national secretary for the coming year. Floyd W. Eaton was appointed treasurer, and Adrian L. Potter was re-elected executive secretary.

Ray H. Morris, New President of the American Society of Tool Engineers

Douglas D. Burnside, First Vice-president of the Society of Tool Engineers

C. W. Briner, Newly Elected Second Vice-president of the Tool Engineers

Direct-Current Adjustable-Speed Drives for Machine Tools

Development of the Adjustable-Voltage, Direct-Current Drive has Resulted in Many Variations with Improved Characteristics, Suitable for a Wide Range of Machine Tool Applications. Five Forms of This Type of Drive will be Described in a Series of Three Articles, of which This is the Second

By G. A. CALDWELL, Industry Engineering Department
Westinghouse Electric & Mfg. Co.

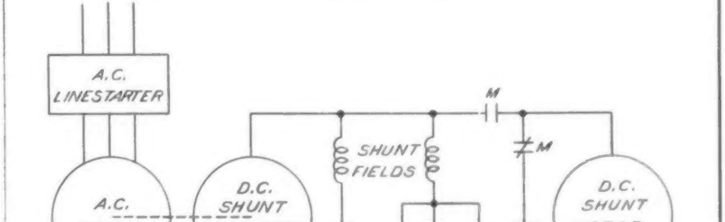
THE conventional adjustable-voltage drive and a simplification of that type—the series variable-voltage drive—were described in the first article of this series, published in April MACHINERY, page 207. A second form of simplified adjustable-voltage drive in which the exciter has been eliminated is the self-excited shunt adjustable-voltage drive. In this form, a shunt-wound direct-current motor and a shunt-wound generator are used, but the units are both connected so that they are excited from the generator, as indicated in Fig. 7.

The generator in this system departs from the conventional design in that it must be stable at a materially reduced voltage when operating self-excited. By "stable" is meant that, in successive operations, the generator will repeat and hold its voltage with a reasonable degree of accuracy. When considered from the standpoint of the generator saturation curve, the "minimum stable point" may be said to be that voltage at which the curve begins to depart appreciably from a straight line.

In Fig. 8 we see that an ordinary generator, when controlled by a rheostat of the usual design, will be stable down to approximately 60 per cent of rated voltage at no load. This would allow operation only over an adjustable-voltage range of slightly less than 2 to 1, which is insufficient for most applications. To widen this range, the generator must be designed to be stable at some lower voltage, and this can be done by introducing additional saturation or, in other words, departing from a straight line in the saturation curve at some lower voltage. With the generator designed for stable operation at 25 per cent of its rated voltage, a speed range in excess of 3 to 1 can be used.

The motor for this system differs from standard only in that its shunt field is designed to give full excitation with but one-third the rated voltage of the generator applied to it, if the voltage range of the system is to be 3 to 1. If the motor is designed for a 4 to 1 range by field control, then the total range of this drive will be 12 to 1.

Fig. 7. A Shunt-wound Motor and Generator are Used in This Self-excited Shunt Adjustable-voltage Drive. Both Units are Excited from the Generator



SCHEMATIC DIAGRAM OF SELF-EXCITED ADJUSTABLE-VOLTAGE DRIVE WITH DYNAMIC BRAKING & FULL FIELD STARTING

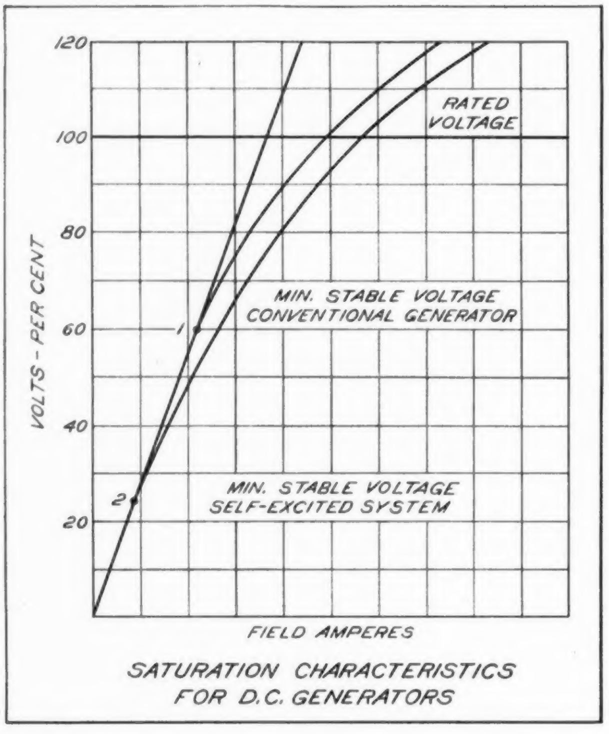


Fig. 8. A Conventional Generator will Accurately Repeat and Hold its Voltage for Any Given Setting down to about 60 Per Cent of its No-load Voltage. The Generator Used in the Self-excited Shunt Adjustable-voltage Drive will Hold its Voltage down to One-quarter of its No-load Voltage

The speed control of this drive is obtained by means of a rheostat that has two plates mechanically connected, one plate being in the generator field circuit and the other in the motor field circuits. In the low-speed position, the motor is at full field and the generator at weak field.

The rheostat is designed so that as resistance is cut out of the generator field to raise the generator voltage, the resistance in series with the motor field is increased at a rate that will maintain full-field motor current. The generator reaches full voltage at about 180 degrees rotation of the rheostat, and further rotation weakens the motor field to obtain higher speeds, but does not affect the generator voltage. Since the motor is designed for full-field excitation at one-third normal voltage, the rheostat losses are approximately three times those normally obtained on a shunt-wound direct-current motor, resulting in somewhat decreased efficiency and also in an increase in the cost of the rheostat itself.

Starting Torque is Over Three Times Full-Load Torque

The self-excited adjustable-voltage drive uses equipment that is approximately the same as the one used in the conventional adjustable-voltage drive; consequently, its performance is essentially the same. Typical speed regulation curves are shown in Fig. 9. The speed regulation is best with the motor operating at full field and the generator at full voltage. This speed regulation is somewhat better than that obtained with the series variable-voltage drive at high speeds, but is not so good as the speed regulation obtained with the series variable-voltage drive at low speeds. Its starting or break-away torque at low speeds is more nearly in line with that obtained with the conventional system, being somewhat over 300 per cent of full-load torque.

Since part of the speed range of this drive is obtained by shunt field control of the motor, it develops a constant horsepower over that portion of the range and a constant torque over the portion of the range obtained by voltage control. It is therefore particularly suited to those loads that have a tendency to require high continuous running torques at low speeds and light continuous running torques at high speeds.

Driving Motor is Started and Stopped Independently

As there is an appreciable time element involved in building up the field of a self-excited shunt generator, this drive is normally operated by allowing the motor-generator set to run continuously, while the motor is started and stopped by closing the main line contactor between the motor and the generator. A field relay is also included, and is connected so that when the line contactor is open, the motor is at full field and the generator at minimum field, which gives about one-third of normal generator voltage. For starting, the line contactor is closed, which starts the motor at full field and at low-armature voltage. When the line contactor closes, the field relay also operates to increase the generator field and weaken the motor field to the position determined by the setting of the rheostat. This causes the motor to accelerate to its preset speed.

Since this drive has both the motor and generator fields excited from the generator, the motor field is excited in the "off" position, and dynamic braking can be obtained in the conventional manner by means of a dynamic braking resistor connected across the armature. Motor reversing can also be obtained by using a pair of reversing contactors. The normal control features, such as inching, slowdown, etc., can be obtained with this type of control in much the same manner as with conventional adjustable-voltage control. It is naturally more flexible than the series variable-voltage type of drive with respect to these refinements, and it is also more satisfactory on pulsating and reversing types of loads.

This simplified form of adjustable-voltage

drive has been developed in cooperation with G. A. Spohn, of the General Machinery Co., and several units are in successful operation. It is expected that this form of drive will be satisfactory for many applications, especially those requiring constant horsepower characteristics over at least part of the speed range.

Voltage Control Replaces Mechanical Gear Shifting

It should not be assumed that the exciter must be eliminated to simplify the adjustable-voltage type of drives. On applications where the requirements are primarily one of speed range in excess of that which can be obtained with the drives mentioned, the over-all system can be simplified, even though an exciter is used.

To illustrate this point, let us refer to an automatic screw machine. In order to simplify the mechanical drive on the feed of the automatic screw machine, it is desirable to eliminate the mechanical speed-changing mechanism. This feed drive must operate over a speed range of at least 25 to 1, and the feed must quickly change from one speed to the other to give different rates of feed for various machining operations in the automatic cycle. These various speeds have previously been obtained by a mechanical variable-speed transmission.

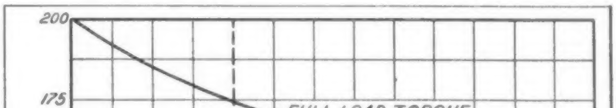
To eliminate all the mechanical gear shifting mechanism, a conventional adjustable-voltage drive is applied, consisting of a small direct-current motor with power supplied from a unit-frame motor-generator set, as shown in Fig. 10. In this particular case, a Rectox unit is used as a source of excitation for the motor and generator instead of a separate exciter, as the Rectox unit can be more conveniently mounted than the separate exciter generator.

The motor is supplied with a shunt field operating continuously at full field value, and the entire speed range is obtained by voltage control. This is done primarily to simplify control operation. The direct-current generator is equipped with three fields, a main field which is used to regulate the speed of the motor by varying the generator voltage, and a second field that is connected as a differential to the main field. This permits the generator output voltage to be brought down to a very low value, which will even buck down residual voltage if necessary without requiring an excessive amount of resistance in the main generator field rheostats. The third field on the generator is a series field, which gives an excitation proportional to load, and compensates for the IR drop of the system to give satisfactory speed regulation at all speeds.

A selector switch and a group of duplicate rheostats are all connected in series with the main generator field; and the selector switch, as it moves from one point to another successively, connects one rheostat and then another in the circuit. By adjusting these rheostats to different values of resistance, a different speed is obtained for each point of the selector switch. Each rheostat has sufficient resistance to cover the entire speed range of the equipment. The selector switch is mechanically connected to the machine, and as the machine changes from one operation to another, the selector switch is mechanically rotated to the next point.

With this combination, we have a drive that runs only in one direction and operates over a speed range of 25 to 1 or more by voltage control alone. This drive can also be set up to automatically give a number of predetermined speeds as the machine goes through its automatic cycle. The complete equipment consists of the conventional shunt-wound direct-current motor, a standard unit-frame motor-generator set, the generator having one additional field over that of a standard compound wound generator, a standard line starter for the motor-generator set, and an operator's panel, on which are mounted the necessary rheostats. No magnetic control equipment, except the line starter, is required.

The range by voltage control is greater than what is normally considered possible, but it can



SPEED REGULATION OF SELF-EXCITED ADJUSTABLE-VOLTAGE DRIVE

Fig. 9. Speed Regulation is Best in This Drive with Motor Operating at Full Field and Generator at Full Voltage. Speed Range may be 12 to 1 when Both Voltage and Field Control are Utilized

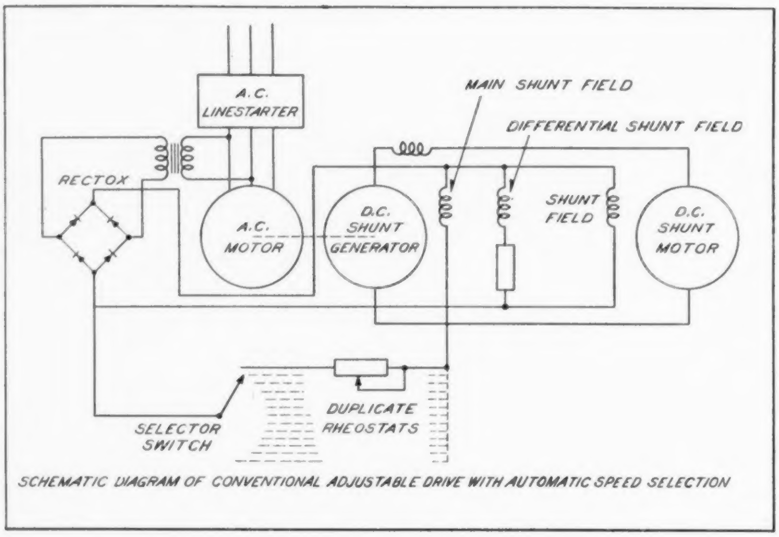


Fig. 10. Conventional Adjustable-Voltage Drive with Rectox Exciting Unit and Automatic Speed Selection. A Complete Cycle of Different Speeds can be Preset, and the Drive will Repeat This Cycle with Less than 5 Per Cent Variation, Plus or Minus

be accomplished in this case because there is practically no variation in torque, the horsepower load is almost directly proportional to speed, and the size of the equipment is sufficient for handling the actual load involved. The main point of interest in this drive is that, on each point of the selector switch, the motor runs at approximately the same speed, as it repeats its automatic cycle. Tests at the customer's plant have indicated that the machine will go through its complete cycle for hours at a time, and that the speed at any given point can be depended upon to repeat itself with less than plus or minus 5 per cent variation.

This application represents what can be done with simple electrical equipment to produce a result that is very difficult to obtain mechanically. The only additional electrical apparatus mounted on the machine, not previously used, consists of the small unit-frame motor-generator set, which is less than 2 feet long, and, incidentally, has a shaft extension which is connected mechanically to the machine during a certain part of the cycle to obtain a high return speed.

Regulation Devices Necessary for Wide Range in Load

If we are able to obtain a speed range of 25 to 1 with equipment as simple as that just described, then why is it necessary to employ regulating devices on other machines that are operating over the same speed range or less? The reason is that these drives are operating over an extremely wide range in load, and must carry this range in load at any given speed. Also, many of the jobs must have very rapid reversing, such as a reversing planer drive. The development of the adjustable-voltage planer drive that uses the regulating generator called "Rototrol" is widely known throughout the machine tool industry, and hence will not be described in detail here. However, the experience obtained with this type of drive has led to the development of a wide-speed range drive that will give speeds as high as 120 to 1, and that is the next type of drive we wish to discuss.

* * *

Lead-Base Bearings May Solve Tin Shortage Problem

Tests recently undertaken on bearing metals by the Cooper-Bessemer Corporation, Mount Vernon, Ohio, point to savings of nearly the entire tin content of bearing babbitt and the possibility of eliminating costly anchoring methods. The elimination of anchoring methods is made possible through the use of a comparatively new metal-cleaning method known as the "Kolene" process. By means of this process, an exceptionally firm and uniform bond is obtained between lead-base babbitt alloys and the Meehanite metal from which the Cooper-Bessemer bearing shells are cast. Briefly, this process is carried out as follows:

The bearing shells are first dipped into a hot molten salt bath to remove the carbon (graphite) particles in the cast iron. By cleaning out these particles in the metal, a considerable amount of anchoring surface is added for bonding the babbitt.

After rinsing, the bearing backings are placed in another salt bath to reduce the surface oxidation resulting from the first bath. Then the backings are again rinsed and are suspended for a few seconds in cold hydrochloric acid before being dipped in a flux and placed in a low tin content alloy which forms a uniform coating on the bearing surface.

The bearing backings so coated are placed in jigs and babbitt is poured against them, forming a strong bond that will withstand the stresses caused by the operation of large engines.

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MACHINERY'S DATA SHEETS 489 and 490

LENGTH OF CHORD FOR LAYING OUT EQUAL SPACINGS AROUND A CIRCLE—3

No. of Equal Spacings or Arcs N	Diameter of Circle D: 1 ($\sin \frac{360°}{2N}$)	2	3	4	5	6	7	8	9
	Length of Chord L								
50	0.062791	0.125582	0.188373	0.251164	0.313955	0.376746	0.439537	0.502328	0.565119
51	0.061561	0.123122	0.184683	0.246244	0.307805	0.369366	0.430927	0.492488	0.554049
52	0.060378	0.120756	0.181134	0.241512	0.301890	0.362268	0.422646	0.483024	0.543402
53	0.059241	0.118482	0.177723	0.236964	0.296205	0.355446	0.414687	0.473928	0.533169
54	0.058145	0.116290	0.174435	0.232580	0.290725	0.348870	0.407015	0.465160	0.523305
55	0.057089	0.114178	0.171267	0.228356	0.285445	0.342534	0.399623	0.456712	0.513801
56	0.056070	0.112140	0.168210	0.224280	0.280350	0.336420	0.392490	0.448560	0.504630
57	0.055088	0.110176	0.165264	0.220352	0.275440	0.330528	0.385616	0.440704	0.495792
58	0.054139	0.108278	0.162417	0.216556	0.270695	0.324834	0.378973	0.433112	0.487251
59	0.053222	0.106444	0.159666	0.212888	0.266110	0.319332	0.372554	0.425776	0.478998
60	0.052336	0.104672	0.157008	0.209344	0.261680	0.314016	0.366352	0.418688	0.471024
61	0.051479	0.102958	0.154437	0.205916	0.257395	0.308874	0.360353	0.411832	0.463311
62	0.050649	0.101298	0.151947	0.202596	0.253245	0.303894	0.354543	0.405192	0.455841
63	0.049846	0.099692	0.149538	0.199384	0.249230	0.299076	0.348922	0.398768	0.448614
64	0.049068	0.098136	0.147204	0.196272	0.245340	0.294408	0.343476	0.392544	0.441612
65	0.048313	0.096626	0.144939	0.193252	0.241565	0.289878	0.338191	0.386504	0.434817
66	0.047582	0.095164	0.142746	0.190328	0.237910	0.285492	0.333074	0.380656	0.428238
67	0.046872	0.093744	0.140616	0.187488	0.234360	0.281232	0.328104	0.374976	0.421848
68	0.046184	0.092368	0.138552	0.184736	0.230920	0.277104	0.323288	0.369472	0.415656
69	0.045514	0.091028	0.136542	0.182056	0.227570	0.273084	0.318598	0.364112	0.409626
70	0.044865	0.089730	0.134595	0.179460	0.224325	0.269190	0.314055	0.358920	0.403785
71	0.044234	0.088468	0.132702	0.176936	0.221170	0.265404	0.309638	0.353872	0.398106
72	0.043619	0.087238	0.130857	0.174476	0.218095	0.261714	0.305333	0.348952	0.392571
73	0.043022	0.086044	0.129066	0.172088	0.215110	0.258132	0.301154	0.344176	0.387198
74	0.042441	0.084882	0.127323	0.169764	0.212205	0.254646	0.297087	0.339528	0.381969
75	0.041876	0.083752	0.125628	0.167504	0.209380	0.251256	0.293132	0.335008	0.376884
76	0.041325	0.082650	0.123975	0.165300	0.206625	0.247950	0.289275	0.330600	0.371925
77	0.040789	0.081578	0.122367	0.163156	0.203945	0.244734	0.285523	0.326312	0.367101
78	0.040266	0.080532	0.120798	0.161064	0.201330	0.241596	0.281862	0.322128	0.362394
79	0.039757	0.079514	0.119271	0.159028	0.198785	0.238542	0.278299	0.318056	0.357813
80	0.039260	0.078520	0.117780	0.157040	0.196300	0.235560	0.274820	0.314080	0.353340
81	0.038775	0.077550	0.116325	0.155100	0.193875	0.232650	0.271425	0.310200	0.348975

See Data Sheet No. 487, April, 1943, for explanation of use of this table.

MACHINERY'S Data Sheet No. 489, May, 1943

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

LENGTH OF CHORD FOR LAYING OUT EQUAL SPACINGS AROUND A CIRCLE—4

No. of Equal Spacings or Arcs N	Diameter of Circle D: 1 ($\sin \frac{360°}{2N}$)	2	3	4	5	6	7	8	9
	Length of Chord L								
82	0.038303	0.076606	0.114909	0.153212	0.191515	0.229818	0.268121	0.306424	0.344727
83	0.037841	0.075682	0.113523	0.151364	0.189205	0.227046	0.264887	0.302728	0.340569
84	0.037391	0.074782	0.112173	0.149564	0.186955	0.224346	0.261737	0.299128	0.336519
85	0.036952	0.073904	0.110856	0.147808	0.184760	0.221712	0.258664	0.295616	0.332568
86	0.036522	0.073044	0.109566	0.146088	0.182610	0.219132	0.255654	0.292176	0.328698
87	0.036102	0.072204	0.108306	0.144408	0.180510	0.216612	0.252714	0.288816	0.324918
88	0.035692	0.071384	0.107076	0.142768	0.178460	0.214152	0.249844	0.285536	0.321228
89	0.035291	0.070582	0.105873	0.141164	0.176455	0.211746	0.247037	0.282328	0.317619
90	0.034900	0.069800	0.104700	0.139600	0.174500	0.209400	0.244300	0.279200	0.314100
91	0.034516	0.069032	0.103548	0.138064	0.172580	0.207096	0.241612	0.276128	0.310644
92	0.034141	0.068282	0.102423	0.136564	0.170705	0.204846	0.238987	0.273128	0.307269
93	0.033774	0.067548	0.101322	0.135096	0.168870	0.202644	0.236418	0.270192	0.303966
94	0.033415	0.066830	0.100245	0.133660	0.167075	0.200490	0.233905	0.267320	0.300735
95	0.033063	0.066126	0.099189	0.132252	0.165315	0.198378	0.231441	0.264504	0.297567
96	0.032719	0.065438	0.098157	0.130876	0.163595	0.196314	0.229033	0.261752	0.294471
97	0.032382	0.064764	0.097146	0.129528	0.161910	0.194292	0.226674	0.259056	0.291438
98	0.032052	0.064104	0.096156	0.128208	0.160260	0.192312	0.224364	0.256416	0.288468
99	0.031728	0.063456	0.095184	0.126912	0.158640	0.190368	0.222096	0.253824	0.285552
100	0.031411	0.062822	0.094233	0.125644	0.157055	0.188466	0.219877	0.251288	0.282699
101	0.031100	0.062200	0.093300	0.124400	0.155500	0.186600	0.217700	0.248800	0.279900
102	0.030795	0.061590	0.092385	0.123180	0.153975	0.184770	0.215565	0.246360	0.277155
103	0.030496	0.060992	0.091488	0.121984	0.152480	0.182976	0.213472	0.243968	0.274464
104	0.030203	0.060406	0.090609	0.120812	0.151015	0.181218	0.211421	0.241624	0.271827
105	0.029915	0.059830	0.089745	0.119660	0.149575	0.179490	0.209405	0.239320	0.269235
106	0.029633	0.059266	0.088899	0.118532	0.148165	0.177798	0.207431	0.237064	0.266697
107	0.029356	0.058712	0.088068	0.117424	0.146780	0.176136	0.205492	0.234848	0.264204
108	0.029085	0.058170	0.087255	0.116340	0.145425	0.174510	0.203595	0.232680	0.261765
109	0.028818	0.057636	0.086454	0.115272	0.144090	0.172908	0.201726	0.230544	0.259362
110	0.028556	0.057112	0.085668	0.114224	0.142780	0.171336	0.199892	0.228448	0.257004
111	0.028299	0.056598	0.084897	0.113196	0.141495	0.169794	0.198093	0.226392	0.254691
112	0.028046	0.056092	0.084138	0.112184	0.140230	0.168276	0.196322	0.224368	0.252414
113	0.027798	0.055596	0.083394	0.111192	0.138990	0.166788	0.194586	0.222384	0.250182

See Data Sheet No. 487, April, 1943, for explanation of use of this table.

MACHINERY'S Data Sheet No. 490, May, 1943

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

Sorting Machine Saves 200 Pounds of Rivets a Day

THE sorting of rivets entirely by hand is not an economical procedure, but sometimes aircraft plants are obliged to reclaim all rivets dropped by the workmen because no more are immediately procurable. To eliminate hand sorting and to conserve critical material, the Fisher Body Division of General Motors developed the rivet sorting machines shown in the accompanying illustration. The revolving cylinders at the left sort the rivets according to thickness. The sorted rivets are then placed in hoppers at the center of the machine from which they slide down to the rotating disk-like selector at the right. This selector first sorts the rivets according to the head type, and then separates the different lengths.

The rivet sorting machines operate on a two-shift per day schedule, with an output of about 200 pounds of reclaimed rivets per day. This saving is an important item, since approximately 250,000 aluminum rivets are used in the average medium bomber. During a day's work on a bomber, each riveter may handle hundreds of rivets ranging from 1/16 to 1/4 inch in diameter and from 1/16 to 1 5/8 inches in length.

In the Fisher aircraft plant more than forty different kinds of rivets are used each day, including round-, flat-, oval-, button-, and brazier-head types. In addition to aluminum rivets, there are rivets of steel, copper, and iron. For each head type there may be many different lengths, so that the result is an assortment of more than 220 lengths of rivets with different types of heads, made from different materials.

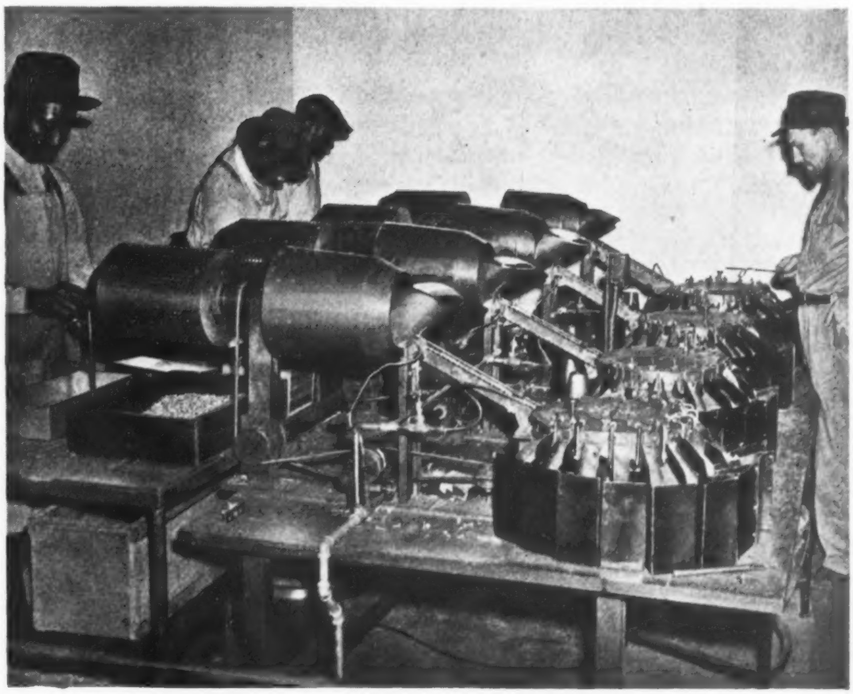
Each of the four machines in the battery illustrated has a primary selector consisting of a perforated revolving cylinder. The perforations in each of the cylinders are of a different size so that the rivets that fall through are separated into four different groups according to thickness, regardless of their length or type of head. The perforated cylinders are interchangeable, there being one perforated cylinder for each thickness of rivet used in the plant.

After being sorted according to thickness and dropped into the hopper, the rivets are carried on a pronged trough to the next selecting unit. At the bottom of the trough, the rivets, with their heads upward, reach a flat disk-like selector, which is notched and which revolves constantly. Each rivet slides into one of the notches. Then, as the selector turns, the various head types are kicked off by the selector arms. If the machine is set for the selection of round-head rivets, all other types are kicked off into a container, the round-head rivets continuing on for selection with respect to length. The sorting machine is then set for the selection of flat-head rivets, the remaining types being kicked off while the flat-head rivets are sorted according to length.

The third and final phase of the sorting operation—that of separating the rivets according to their length—is performed by the circular selector, which has a dozen or more small channels. As this selector revolves, small rods or needles kick the rivets out into containers according to their length. The sorting machines illustrated have transformed a task that was tedious and unprofitable, except in an emergency, into a regular economical practice.

* * *

The Tool Division of the War Production Board has announced that during February, 25,500 machine tool units, having a value of $114,372,000, were shipped from the machine tool plants. These figures are based on reports received from 381 machine tool building firms.



Rivet Sorting Machines Used in Aircraft Plant to Reclaim Two Hundred Pounds of Rivets Daily

Standard Markings for Grinding Wheels

By HARRY B. LINDSAY, Secretary-Treasurer
Grinding Wheel Manufacturers Association

IN dealing with the important steps that have been taken to standardize the markings for grinding wheels, some brief historical notes may be of interest. Prior to 1885, polishing and grinding were done with grindstones and whetstones hewn from natural abrasive rock to shapes adapted for their use. These abrasive tools were succeeded by the emery wheel, formed by binding together natural emery by means of a vitreous mixture of fired potter's clays.

In 1893, grinding wheels were first made of a manufactured or artificial abrasive material—silicon carbide. In 1900, research had led to the production of a second type of manufactured abrasive material in commercial quantities—aluminum oxide—and from that time on, abrasive products have played an important part in all metal-manufacturing practices.

It is not so long ago that grinding wheels were described simply by a number indicating grain or grit size and a letter designating hardness or grade. There are old-timers in many shops today who will attempt to grind anything to any required finish and "right to the mark" (plus or minus 0.001 inch) with a 46-L "emery wheel." The 46-L might be a corundum wheel, an emery wheel, an aluminum-oxide wheel, or a silicon-carbide wheel; and, given time and a good diamond truing tool, the old-timer will succeed.

With the introduction of production lines and operators who know only one machine operation, there came the demand for specialized grinding wheels, hones, and coated abrasive products. Therefore, grinding-wheel manufacturers adopted additional symbols to indicate the kind of abrasive, structure, bond, and combinations of grain sizes. In a highly competitive industry, it was only natural that these symbols should vary according to the manufacturer; but each set of symbols represented to the wheel manufacturer and to the user the possibility of duplication of grinding action. This duplication of grinding action, day after day, irrespective of the operator, is the one and only reason for grinding-wheel markings.

To each grinding-wheel manufacturer and to the user of wheels purchased from one manufacturer only, the symbol stamped in the lead bushing or imprinted on the blotter or wheel served as perfect identification; but in large organizations, where grinding wheels made by different manufacturers were transferred from machine to machine and from department to department, it became important that grinding-wheel markings should be sufficiently uniform to identify the kind of wheel used, irrespective of its manufacturer. This need gave rise to a prolonged study, of which the American Standard Markings for Grinding Wheels—known as B5.17-1943—is the result.

This standard provides symbols for the following items: (1) Abrasive; (2) grain size; (3) hardness or grade; (4) structure; (5) bond or bonding process; (6) manufacturer's record or identification.

The first item indicates eight varieties of abrasives; the second, twenty-eight grain sizes, with suffixes indicating four possible combinations for each of the twenty-eight nominal grain sizes; the third, twenty-one variations of hardness or grade; the fourth, nine variations of structure, three of the nine being indicated as preferred; and the fifth, six variations in bonding processes.

The following is a typical wheel marking with six symbols, which represent the six characteristics listed and in the same order:

B 461 M2 5 V E

The meaning of each letter or symbol in this marking is as follows:

"B" signifies aluminum oxide, refined.

"461" indicates the standard grain size.

"M2" indicates the hardness on the standard grade scale. In this case, the wheel is medium hard in the second of seven classifications.

"5" stands for the structure. The figures run from 1 to 9; No. 1 represents the greatest density, No. 5 is medium, and No. 9 is the most porous or open.

"V" signifies the bond or bonding process—in this case vitrified.

"E" is the manufacturer's record symbol. Each grinding-wheel manufacturer may use his own symbol for his factory records.

The grinding-wheel manufacturer may also use a set of markings according to his own individual system, placed in a line below the standard marking.

A complete description of the new American Standard Markings for Grinding Wheels can be obtained from the American Standards Association, 29 W. 39th St., New York City.

The grinding-wheel manufacturers expect that this new American standard will eventually

be adopted by all users in ordering new wheels. There are, however, engineering reasons why no ready reference system will solve all wheel-choice problems, because no standard marking can insure identical grinding action, as this means identical and uniform wheels from every source, which is, obviously, difficult to guarantee. Furthermore, uniform production depends not only on the wheels, but also upon the condition and design of the grinding machine used, the material being ground, the tolerances permissible, the finish required, and the output in a given time.

Furthermore, to obtain absolute uniformity in different wheel-manufacturing plants in all such matters as the adhesion of the bond to the abrasive grains, the tensile strength, the compressive strength, the modulus of elasticity, the ductility or cold flow, and the effect of temperature, obviously, is not possible. Thus it happens that identically marked grinding wheels may not always perform exactly alike, but the standard markings are a tremendous step forward in securing uniform results.

It is believed that the general adoption of the new standard must be a gradual process, acceptable to each individual wheel user. At times there must be "tailor-made" wheels which cannot be catalogued into a universal standardized plan. As a matter of fact, grinding-wheel manufacturers, hard pressed to supply the urgently needed tools of war production, cannot spare the workers to apply currently to their entire output the dual marking system which will be indispensable both to maker and user until the old-timer in the shop is as familiar with the American standard marking as he once was with the old symbols. During the transition period, there must be a serious effort on each side to meet the conditions confronting the other.

* * *

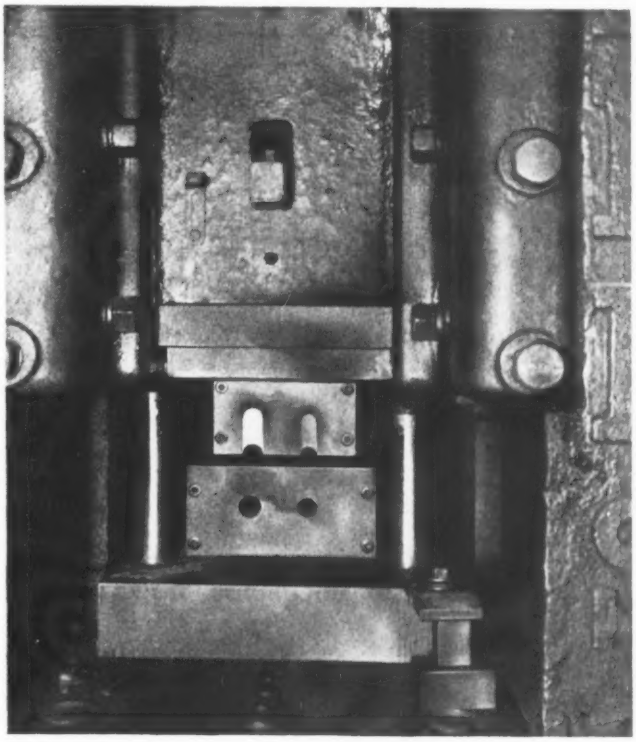
Greater efficiency, rather than long hours, constitutes the real solution to the man-power problem, in the opinion of James F. Lincoln, president of the Lincoln Electric Co., Cleveland, Ohio. This opinion is based on the experience of the Lincoln Electric Co., where, chiefly as the result of an incentive plan, the production per worker has reached astonishingly high levels.

"If management does its job so that labor has the tools, material, and 'know how' to obtain maximum production," said Mr. Lincoln, "there is, with a proper incentive, very little doubt that a work-day of over eight hours will actually bring about a loss of production. In the experience of the Lincoln Electric Co., properly applied incentives will increase production rates as much as three times."

Cut-Off Die Speeds up Cutting-Off Operation

By DAVID DEASY
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Copper and brass slugs for hot-pressing operations can be produced faster by using a cut-off die than by sawing. In the East Pittsburgh



This Simple Die is Used for Cutting off Copper and Brass Bars for Making Slugs for Hot-pressing Operations

works of the Westinghouse Electric & Mfg. Co., slugs that were produced at the rate of ten pieces per minute by sawing are now turned out by a cut-off die at the rate of forty-five pieces per minute. Slugs cut by this method are true to size and do not have the bent ends that sometimes result from shearing.

* * *

Plastic Cases for Turbo-Blowers

The growing use of plastics in the industrial field is exemplified by the design of a turbo type wheel blower built by the L-R Mfg. Co., Torrington, Conn. In this blower, the housing is made from a one-piece, high-impact molded plastic capable of withstanding a temperature of 230 degrees F.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 183 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the May Number of MACHINERY

Aircraft Alloy Steel Handbook

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Handbook on "Aircraft Alloy Steels," listing available aircraft steel stocks, prices, sales limitations, and specifications. In addition, the book tabulates, in condensed form, the Aeronautical Material Specifications pertaining to steel, including the new NE steels. Copies are obtainable by buyers and technical men in the aircraft and aircraft parts manufacturing industries. 1

Service Manual for Pneumatic Die Cushions

DAYTON ROGERS MFG. CO., 2835 Twelfth Ave., S., Minneapolis, Minn. Instruction and Service Manual for pneumatic die cushions. Bulletin F156, describing several designs of pneumatic cushions for different types of dies. 2

Reconditioning of Pump Shafts and Rods

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Booklet describing four different methods of renewing worn metal parts, such as pump rods and shafts. 3

Pneumatic Control

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Catalogue N-00B, descriptive of Micromax pneumatic control for regulating temperature, gas concentration, conductivity, and other controllable conditions. 4

Inspection Equipment

GEORGE SCHERR CO., INC., 126 Lafayette St., New York City. Folder describing the Scherr limited-budget inspection laboratory, including fourteen types of measuring instruments, tools, gages, and optical inspection devices. 5

Industrial Machinery Lighting

RELIANCE DEVICES CO., INC., 510 Sixth Ave., New York City. Catalogue 101, on "Swivelier" sockets and directive lighting units. Catalogue 102, on "Swivelier" Work-Lite" units, universally adjustable and unaffected by machine vibration. 6

Insulated Bushings and Mountings

BUSHINGS, INC., 3442 W. Eleven-Mile Road, Berkley, Mich. Bulletin BU-8, describing the manufacture of Rubberflex insulated bushings and mountings; and Engineering Data Sheet showing thirty typical designs. 7

Universal Bench Millers

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford, Conn. Circular 470, illustrating and describing the Pratt & Whitney No. 3, Model C, universal bench miller for tool-rooms or production lines. 8

Electrical Standards for Fractional-Horsepower Motors

DUMORE CO., Racine, Wis. Illustrated booklet containing a summary of the American electrical standards for fractional-horsepower motors approved by various societies and associations. 9

Universal Angle Drive

PAYNE DEAN & CO., Laconia, N. H. Bulletin illustrating and describing heavy-duty angle drives for power operation; universal angle drives; and manganese-bronze universal joints. 10

High-Speed Grinding Attachment

LIBERTY TOOL & GAGE WORKS, INC., Providence, R. I. Circular descriptive of Liberty high-speed horizontal and vertical grinding attachments, designed to fit popular type surface grinders. 11

Coated Abrasives

BEHR-MANNING CORPORATION, DIVISION OF NORTON CO., Troy, N. Y. Booklet entitled "Blueprint for Faster, Better Production with New Coated Abrasives," showing ingenious ready-to-use shapes of Metalite cloth. 12

Tool and Cutter Grinders

DOUGLAS MACHINERY CO., INC., 150 Broadway, New York City. Catalogue illustrating and describing the new Rotorex universal tool and cutter grinder and its application in sharpening all kinds of tools. 13

Dust Collection and Paint Spray Booths

AQUA-RESTOR DIVISION, MAYER MFG. CORPORATION, 50 Division Place, Brooklyn, N. Y. Bulletin on paint spray booths and dust collection systems. 14

Nitriding Furnaces

NITRALLOY CORPORATION, 230 Park Ave., New York City. 99-page booklet on nitriding furnaces, covering constructional features, capacities, operation, and instrumentation. 15

Turret Lathes

SOUTH BEND LATHE WORKS, South Bend, Ind. Bulletin 1002, descriptive of South Bend 10-inch turret lathes, designed for rapid production of small chucking and bar work to close tolerances. 16

Liquid Salt Baths

E. F. HOUGHTON & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Bulletin on liquid salt baths for carburizing, annealing, tempering, and "neutral" hardening. 17

Strain Gages

BALDWIN SOUTHWARK DIVISION, BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa. Bulletin 171, descriptive of the SR-4 bonded "Metalectric" strain gage and its many applications. 18

Cold-Sawing Machines

MOTCH & MERRYWEATHER MACHINERY Co., 715 Penton Bldg., Cleveland, Ohio. Bulletin describing Motch & Merryweather "Triple Chip" cold-sawing method. 19

Broaching Poster

COLONIAL BROACH Co., P.O. Box 37, Harper Station, Detroit, Mich., is distributing a poster-folder (Bulletin 290) entitled "Broaching Do's and Don'ts." 20

Surface-Angle Plates

THOMAS WILBERTON & Co., Cedar Grove, N. J. Bulletin illustrating and describing the Wilberton combination master surface-angle plates designed to facilitate inspection. 21

Zinc-Alloy Die-Castings

NEW JERSEY ZINC Co., 160 Front St., New York City. Booklet entitled "Zinc-Alloy Die-Castings," prepared to answer the questions most often asked about these die-castings and their application. 22

Guide for Selecting Motor Controls

GENERAL ELECTRIC Co., Schenectady, N. Y. Manual GEA-4015, entitled "Simplified Guide to the Selection and Application of Commonly Used Motor Controls." 23

Stock Thread Gages

DETROIT TAP & TOOL Co., 8432 Butler St., Detroit, Mich., is issuing twice a month stock record sheets containing a list of the stock thread, plug, and ring gages currently available. 24

Air-Operated Welders

PIER EQUIPMENT MFG. Co., Benton Harbor, Mich. Bulletin P-50C, illustrating and describing two new "Peer" air-operated, press type, combination projection and spot welders. 25

Renewing Worn Ball Bearings

AHLBERG BEARING Co., 3025 W. 47th St., Chicago, Ill. Catalogue of especial interest to maintenance men, describing the manufacturing procedure in regrinding worn ball bearings. 26

Cast-Tooth Sprocket Wheels

LINK-BELT Co., 307 N. Michigan Ave., Chicago, Ill. Folder 2067, listing the sizes of cast-tooth sprocket wheels available from stock at Link-Belt plants and warehouses. 27

Vises, Toggle Clamps, and Pliers

KNU-VISE, INC., 2208 Eighth St., Detroit, Mich. Catalogue covering the company's complete line of toggle clamps, pliers, C-clamps, vise grips, and vises. 28

Vertical Milling Attachment

SYRACUSE SMALL TOOL & GAUGE Co., 107 N. Franklin St., Syracuse, N. Y. Leaflet entitled "Double the Efficiency of Your Hand Mill with the New Indeco Vertical Milling Attachment." 29

Armor-Plate Magnetic Chucks

ANDERSON & BROWN Co., 2034 E. 22nd St., Cleveland, Ohio. Circular descriptive of a new armor-plate magnetic chuck designed for handling light, medium, and heavy plates for armored tanks. 30

Electric Switches

FURNAS ELECTRIC Co., Batavia, Ill. Bulletins 4216 and 4301, on cam-operated dome switches de-

To Obtain Copies of New Trade Literature

listed on pages 182-184 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm ....

Business Address ....

City .... *State* ....

[SEE OTHER SIDE]

signed specially for turret lathes and similar machines. 31

Hydraulic Circuits for Machine Tools

VICKERS, INC., 1400 Oakman Blvd., Detroit, Mich. Bulletin describing "traverse and feed cycle" control panels for machine tool hydraulic circuits. 32

Milling Machines, Jig Borers, and Shapers

MACHINERY MFG. CO., 1915 E. 51st St., Vernon, Los Angeles, Calif. Circular on Vernon horizontal and vertical mills, jig borers, shapers, and accessories. 33

Electronic Power Switches for Resistance Welders

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-3058B, on ignitron contactors for alternating-current resistance welding. 34

Handbook of Mechanical Power Transmission

CLING-SURFACE CO., Buffalo, N. Y. Handbook containing information on design and maintenance of group drives, including new data on the Cling-Surface belt treatment. 35

Hoist and Crane Maintenance

ROBBINS & MYERS, INC., HOIST AND CRANE DIVISION, Department M21, Springfield, Ohio. Folder designed to help prevent hoist and crane breakdowns. 36

Selecting Steel for Plastic Molding

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. Folder containing a guide for selecting the right steel for plastic molding. 37

Turret Punch Presses

WIEDEMANN MACHINE CO., 1807 Sedgley Ave., Philadelphia, Pa. Bulletin 92, on turret punch presses with gage tables for short-run piercing operations. 38

Extruded Aluminum Bronze

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 110, entitled "Extruded Aluminum Bronze to Meet Aeronautical Material AMS Specifications." 39

Colloidal Graphite

ACHESON COLLOIDS CORPORATION, Port Huron, Mich. Bulletin 430-YY, discussing the importance of "dag" colloidal graphite to modern industry. 40

Metal Washing Machines

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Circular 9, illustrating and describing the new American Tumbl-Spray metal washing machine. 41

Welding of Pipe

AIR REDUCTION CO., 60 E. 42nd St., New York City. 16-page treatise on the welding of piping. 42

Electric Salt Bath Furnaces

AJAX ELECTRIC CO., INC., Frankford at Delaware Ave., Philadelphia, Pa. Publication entitled "Carburizing Gears in the Electric Salt Bath Furnace." 43

Plastic Materials

CREATIVE PLASTICS CORPORATION, Kent and DeKalb Aves., Brooklyn, N. Y. Folder entitled "Plastics for Your War Production Parts Problem—Without Molds." 44

Bench Bins for Assembly Work

GORDON L. HALL CO., Old Lyme, Conn. Circular of a new type Bin-rack bench bins, used directly on the bench, without racks, for assembly operations. 45

Hard-Facing with Coast Metals

COAST METALS, INC., 1232 Camden Ave., S.W., Canton, Ohio. Booklet entitled "Hard-Facing with Coast Metals Makes Your Equipment Last Longer." 46

Metal-Bonded Diamond Wheels

DIA-TOOL, INC., Yonkers, N. Y. Circular illustrating and describing Dia-Tool metal-bonded diamond wheels. 47

Tool and Maintenance Welders

THOMSON-GIBB ELECTRIC WELDING CO., Lynn, Mass. Circular descriptive of Thomson tool and maintenance flash welders. 48

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 187-208 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in May, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Westinghouse Machine Tool Forum

THE eighth annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was held April 6 and 7. The number of engineers attending from machine tool building companies exceeded the attendance at any previous forums. Approximately one hundred companies were represented, and close to three hundred engineers registered at the meeting.

The papers presented before the meeting pertained to a wide variety of problems now facing industry in general, and the machine tool industry in particular. R. H. Clark and W. J. Pelich, of the Warner & Swasey Co., Cleveland, Ohio, presented a paper on "Tool Grinding and Its Relation to Motor Selection," which was accompanied by a sound-motion film entitled "Chips." This film gave detailed suggestions as to the importance and methods of tool grinding, and also illustrated by slow-motion photography in a very clear manner the action that takes place at the point of a cutting tool when turning various metals.

R. S. Elberty, consulting engineer of the New Britain Machine Co., presented a paper entitled "Mathematical Analysis of Special Control Circuits." In this paper he pointed out that the problems of electrical drives for machine tools are now largely problems of control. It is no longer a matter of just starting and stopping motors. Mr. Elberty also called attention briefly to the part that contacts, conductors, operating members, and conversion devices play in the construction of electrical drives for machine tools.

Electronics at Work

An unusual demonstration of "Electronics at Work" was presented by Dr. P. Thomas, of the Westinghouse Research Laboratories. This demonstration was both instructive and entertaining, indicating as it did how most unusual problems may be solved by the application of "electric eyes" and tubes—that is, by electronics. Following this demonstration, T. R. Lawson, of the Electronics Control Section of the Westinghouse company, read a paper on and demonstrated a new electronic adjustable voltage motor control by means of which it is possible to obtain an exceptionally wide range of motor speeds by using alternating current and rectifying tubes. This development promises to be of considerable importance in machine tool operation as well as in other fields.

How oil mist and smoke may be removed when produced in machine tool cutting operations was dealt with in a paper presented by E. H. R. Pegg, precipitron engineer of the Westinghouse company. This paper showed how electric air cleaning can be effectively used for removing oil mist at machine tools.

The problem of the training of unskilled machine operators is uppermost in the minds of practically every manufacturer throughout the nation. On this subject, Dr. Horace Frommelt, director of education of the Kearney & Trecker Corporation, Milwaukee, Wis., presented a paper that brought out many new ideas of value and interest to the visiting engineers.

One point that was especially stressed by Dr. Frommelt was that visual educational material, while it can be used effectively in training operators, must never be considered as an end in itself. Motion pictures, for example, are a valuable aid in training, but must be accompanied by a well conducted discussion period following their presentation. This, in fact, is true whether the visual presentation takes the form of a motion picture or a still picture. Unless definite questions are directed to those under training immediately following the presentation, in Dr. Frommelt's opinion, no actual training or instruction takes place.

High-Frequency Induction Heating for Heat-Treatment

Induction heating for heating metals for hardening, brazing, soldering, forging, and melting is becoming a more and more important aid in machine shop operation. Frank W. Curtis, chief engineer of the Van Norman Machine Tool Co., Springfield, Mass., read a paper on the future possibilities of induction heating. He described equipment for a process of high frequency induction heating which promises to give two outstanding advantages to industry—economical cost of heating metals and high rate of production with uniform results.

The paper was accompanied by a motion picture that clearly indicated what can be accomplished by this method in heating gears, studs, shafts, and a great variety of other machine parts for subsequent hardening, or for brazing, soldering, or forging. By means of the high frequency current heat can be produced in a predetermined area of a metal part requiring localized hardening.

One of the important events of the meeting was a round table discussion on hydraulic versus electric drives, in which the following engineers took part: R. A. Cole of the Norton Co., Worcester, Mass.; E. Y. Seborg of the Barnes Drill

Co., Rockford, Ill.; E. M. Taylor of the Heald Machine Co., Worcester, Mass.; H. N. Seyferth of Ex-Cell-O Corporation, Detroit, Mich.; G. M. Class of the Gisholt Machine Co., Madison, Wis.; B. P. Graves of the Brown & Sharpe Mfg. Co., Providence, R. I.; and R. Herrstrom of the Rockford Machine Tool Co., Rockford, Ill. In this dicussion the advantages of both electric and hydraulic drives were brought out, and the point was made that both have their place according to the conditions.

At one of the sessions, Tell Berna, general manager of the National Machine Tool Builders' Association, spoke on the accomplishments of the machine tool industry and the present prospects in this industrial field. He also referred to conditions in Washington and industry's part in guiding the production aspects of the war. John Gammell, of the War Production Board, having charge of the Electric Motor Division, and John C. Borden of the Board, having charge of the Electric Control Division, addressed the meeting, outlining present regulations and requirements.

At another of the sessions, G. Edward Pendray, assistant to the president of the Westinghouse Co., under the title "Contributions to Victory," outlined the part that the Westinghouse organization is playing in producing war equipment of a great many types, from ordnance to ship propelling machinery. At the dinner at the end of the sessions, the chief speaker was James Y. Scott, president of the Van Norman Machine Tool Co., who gave a stirring address on the stamina of America under the present trying conditions.

Shortage of Supervision Holds Back Production

By GEORGE S. GOODRICH

ON page 144 of February MACHINERY, the question is asked: "Have You An Idea for Uncle Sam?" Thirty-eight years' experience in a supervisory capacity as assistant foreman, foreman, general foreman, superintendent, and general superintendent prompts the writer to suggest that the most serious shortcoming at present in our war production effort may be lack of competent supervision.

We hear a great deal about the shortage of man-power, but little is said about the shortage of supervision. Workers are encouraged to quit non-defense jobs to find employment in war production plants. Many of these inexperienced workers are being hired by war production plants in which there is not a sufficient number of trained supervisors to handle this green labor efficiently. The result is that thousands of men and women are ringing time-clocks and drawing pay checks, but are not doing efficiently the work of which they are capable.

The writer feels that the farms and many plants making more or less essential things for civil consumption are being drained of their labor only to have this labor inefficiently employed in war production plants. This is not because the workers are incapable, but because the supervisory force is either too small or too recently recruited for the job to be able to keep the new workers efficiently employed.

It is true that a great many supervisory training courses are being sponsored both by the Government and by industry; but supervision is more of an art or a profession than a trade—and how many people can be trained for a profession in a few days or a few weeks?

The writer believes that the managements of our war industries should make a survey of the supervisory personnel to determine how much inexperienced help can be efficiently handled; then that number of men and women should be hired, and no more. If this were intelligently done, I believe that we would find that we have sufficient man-power for our war production plants, with some left over for the small non-defense shops.

Furthermore, we would not only be conserving critical materials now being spoiled by inexperienced, poorly supervised workers, but we would also be conserving critical labor. It is easy to appreciate that the leading men in industry and management are reluctant to believe that they are wasting labor, and labor will be reluctant to admit that it is not as efficient as it could be; but an idea for Uncle Sam has been requested. This is mine.

It is not a suddenly conceived idea, snatched out of the air by a day-dreamer; it is an idea that has been uppermost in the writer's mind during his entire industrial career. It has been proved by facts and figures that more work can be produced by twenty properly trained men than by thirty who are poorly supervised. By the same token, more work can be produced by 20,000 well supervised men in a large plant than by 30,000 poorly supervised ones. If your supervisory force is capable of handling only 20,000 men efficiently, why force 30,000 on them?

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Bremacc "Down Cut" Milling Machine with Twin Lead-Screws

A Model No. 4 milling machine with twin lead-screws arranged to eliminate backlash and thus permit "down cut" milling on a precision, high-speed production basis has been developed by the Bremacc Corporation, 2030 E. Grand Blvd., Detroit, Mich. The first of this series of milling machines, designated as Model No. 3, was brought out about a year ago. These earlier machines have been in use for months, successfully handling some of the toughest kinds of emergency production work.

The two unsplined lead-screws of the new milling machine are so connected that their effective bearing surfaces in the feed-nut are kept constantly in tension through the use of a synchronizer sleeve or backlash eliminator, on which a patent is pending. This synchronizer sleeve is located outside the gear housing in the table. Axial play in the thread shoulders of the lead-screws is entirely eliminated by this arrangement, whether the table moves with or against the direction of cutter rotation under heavy feed or rapid traverse. A housing cast integral with the table carries all the thrust loads and contributes to the sturdiness of the assembly.

Accuracy of the plane of travel of the work-table is provided for by two dovetail ways. The rear slide is securely mounted and permanently fixed, while cross adjustment of the front slide is accomplished by means of adjusting screws without removal of the table. This method avoids the necessity of employing taper gibs. The slides receive lubrication from a gravity system, wick-fed by a large permanent reservoir cast into the table itself. The table is amply channeled and assures rapid disposal of cuttings.

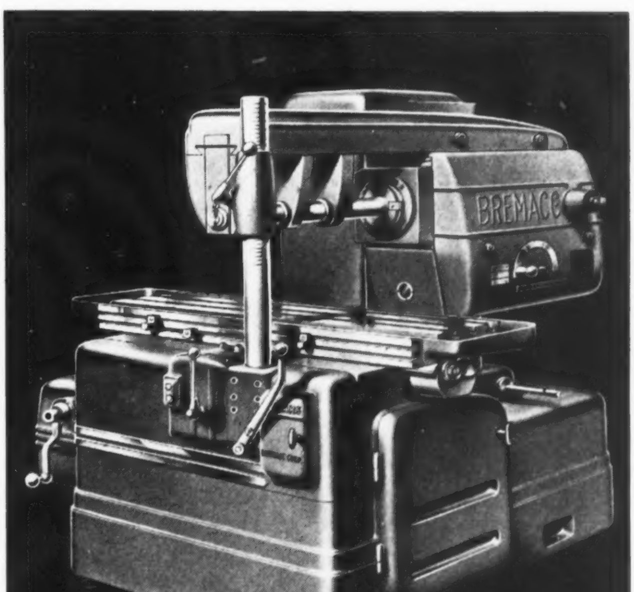
Table feeds ranging from 1/2 inch to 30 inches per minute are obtained through pick-off gears. Rapid traverse of the table is at the rate of 125 inches per minute. Both table feeds and rapid traverse can be operated manually or automatically in either direction. Automatic reversing and jump feeds are also available, permitting the use of work fixtures on both ends of the table.

The table travel is free to function as long as the main motor is in operation, regardless of whether the cutter is rotating or not. The operating lever, controlling the feed and rapid-traverse cycles, is mounted directly in front of the operator in a vertical position. It can be operated manually to select the table feeds or rapid traverse. This lever, in connection with plungers having hardened rollers, can be shifted by table dogs to provide automatic cycle operation. Large double oil type disk clutches are used for both rapid traverse and feeding movements.

The spindle nose is a standard No. 50. A draw-bar is provided, which is operated from the rear of the machine. A Timken preloaded tapered roller bearing is mounted very close to the front end of the spindle, which is driven by a floating gear. Spindle speeds range from 25 to 1250 R.P.M. A 30-degree helix pinion and gear provide smooth driving power to the cutter. All pick-off gears, both feed and speed, are splined and run in oil. Automatic lubrication is provided throughout the machine.

A flexible hose is provided for supplying coolant direct to the cutter. Power is supplied by an individual 10-H.P. motor.

Complete control equipment is mounted in an enclosed cover on the left-hand side of the machine. The table is 20 by 72 inches, and has a maximum length of travel of 48 inches. The maximum distance of the spindle above the table is 20 inches, and the maximum cross travel 10 inches. The machine is 64 inches high, 72 inches wide, 62 inches deep, and weighs 10,500 pounds. 51



Bremacc "Down Cut" Milling Machine with Twin Lead-screw Arrangement Designed to Eliminate Backlash

To obtain additional information on equipment described on this page, see lower part of page 184.

Cleveland Horizontal Production Milling Machine

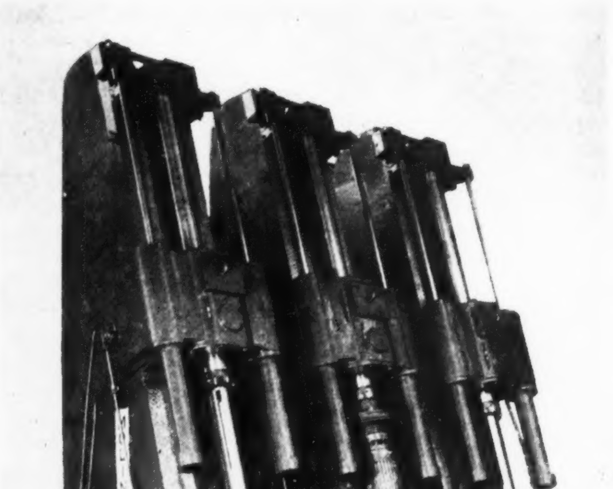
The Sommer & Adams Co., 18511 Euclid Ave., Cleveland, Ohio, has just brought out a No. 1 1/2 horizontal milling machine designed for fast accurate milling and for quick set-ups for either long- or short-run jobs. The table can be set for a full automatic cycle, giving rapid approach, feed, and rapid return from either direction continuously; or it can be arranged to stop on completion of the cycle.

The drive is by multiple V-belt to a constant-speed shaft from a motor that is fully enclosed in the machine base. Eight spindle speeds ranging from 50 to 1000 R.P.M. are obtained by means of pick-off gears and back-gears. Pick-off gears are also provided for obtaining fifteen different feeds ranging from 1/2 inch to 18 inches per minute.

In using the automatic operating cycle, the table immediately traverses forward at a rapid rate when the starting button is pushed. When the feed-cam comes in contact with the limit switch, the table begins its traverse at the milling speed and the cutter starts rotating. When the feeding movement is completed, a cam on the table comes in contact with a control lever on the front of the saddle, causing the table to return to the starting point at the rapid traverse feed and the spindle to stop rotating. This cycle is continuous, the operator loading the fixture at one end of the table while the part in the fixture at the other end is being milled.

The longitudinal power feed is 24 inches, and the cross-feed is 4 inches when the outer support is in place and 8 inches when the support is removed. The vertical feed, by hand only, is 12 inches. The maximum distance from table to center line of spindle is 12 inches. The 3-H.P. motor has a speed of 1800 R.P.M. The floor space required is 58 by 79 inches, and the machine weighs 3250 pounds. 52

Cleveland Milling Machine Brought out by Sommer & Adams Co.



Moline Boring Machine Built for Boring Diesel-engine Sleeves

Moline Cylinder-Sleeve Boring Machine with Hydraulic Feed

A heavy, rigid machine for boring and facing the hydraulic sleeves of large Diesel engines has recently been developed by the Moline Tool Co., Moline, Ill. The illustration shows three of these boring machines tied together to form a three-column unit.

The boring-spindle thrust-bearing assembly and the fixture on each column move on inclined ways, and the boring tools are piloted in bearings above and below the work. Two motors are used on each column, one for driving the spindle and the other for driving the hydraulic feed unit. Two spindle rotational speeds are immediately available by means of a lever.

All functions of the machine are controlled by a combination of

To obtain additional information on equipment described on this page, see lower part of page 184.

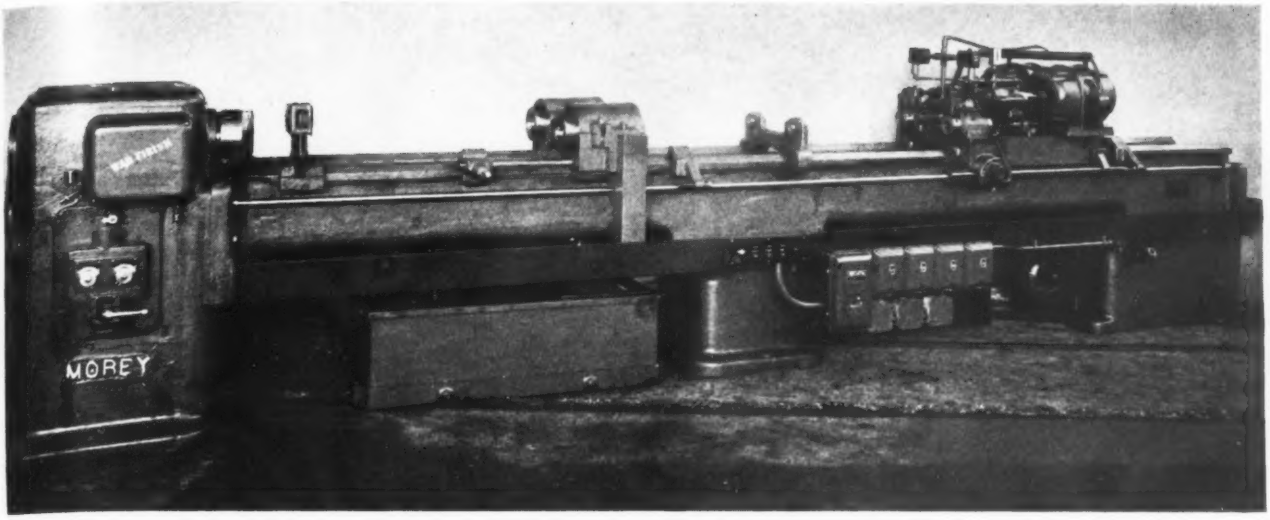


Fig. 1. Morey No. 1 1/2 Duplex Deep-hole Drilling Machine

push-buttons, selector switches, and electrical interlocking devices that prevent any possible errors in the operating sequence. Automatic lubrication of the ways and spindle drive gears is provided. The fixture on each column is set in the extreme "down" position for loading and unloading. For boring, it is set in the extreme "up" position, while for facing, there is an intermediate location that permits the operator to watch the action of the facing tools. 53

Morey Deep-Hole Drilling Machines

The Morey Machinery Co., Inc., 410 Broome St., New York City, has placed on the market the Model No. 1 1/2 duplex deep-hole drilling machine shown in Fig. 1, which embodies a hydraulic feed designed to make instantly available the exact feed required for the work being handled. The feeds and power traverse in each direction are controlled by a single "directional type" lever.

The drill-holder carriage is provided with automatic control for stopping the motors in case a drill slips in either of the drill-holders or the cutting lubricant pressure drops. The high-duty coolant pump, driven by a separate motor, is protected by filters. Pick-off gears are employed for the selection of the exact spindle speed required.

Another deep-hole drilling machine, shown in Fig. 2, has been placed on the market by this concern. This machine is designated the No. 4 1/2, and is of the single-spindle type. It is mechanically actuated, and has been designed and built for boring 90-millimeter anti-aircraft gun barrels. 54

Simplex Metal-Parts Washing Machine

The Sturdy-Bilt Equipment Corporation, West Allis, Milwaukee, Wis., has brought out a new "Simplex" metal-parts washing machine. This improved automatic unit is designed for the efficient cleaning and washing of small metal parts, castings, stampings, etc. Either hot or cold cleaning solutions can be used.

The tank is fully insulated, and the cleaning solution can be heated to a temperature of 120 to 130 de-

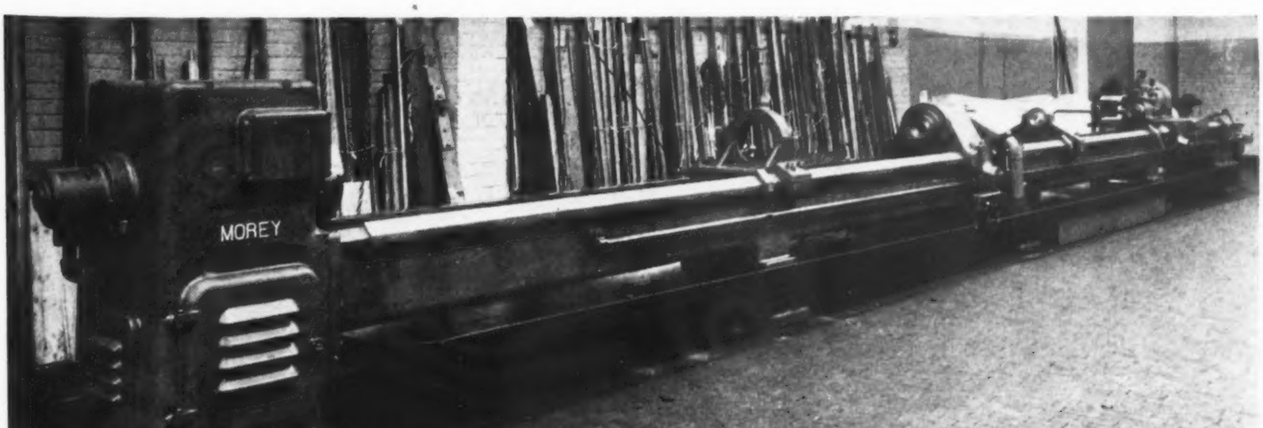


Fig. 2. Single-spindle No. 4 1/2 Deep-hole Drilling Machine Built by Morey Machinery Co., Inc.

To obtain additional information on equipment described on this page, see lower part of page 184.

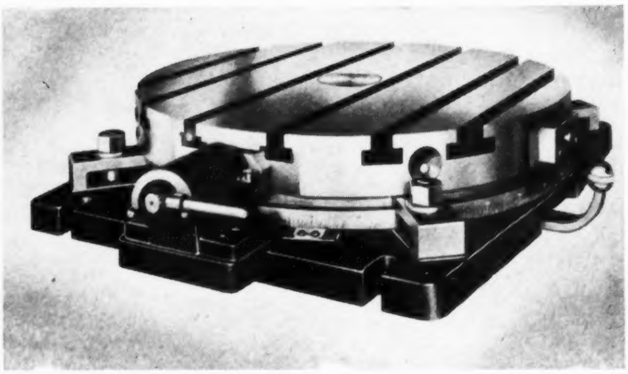
grees by means of gas, steam, or electricity. An electric motor operates a simple mechanism that lowers and raises the material tray into and out of the soaking tank. The operator simply has to load the material tray and press a switch, after which the cleaning operation is automatically performed.

This washing machine is furnished in three sizes, having capacities of 130, 265, and 450 gallons of cleaning solution. 55

Ohio Revolving Tables for Machine Tools

Several types and combinations of round and square revolving tables in sizes ranging from 24 to 96 inches in diameter are being built in plain, worm-feed, and power-feed types by the Ohio Machine Tool Co., Kenton, Ohio. These tables can be arranged to suit many types of machine tools, including milling, drilling, and horizontal boring machines.

Plain revolving type tables can be furnished without baseplates for work requiring a low table. Tables can be supplied with or without index-pin and bracket or precision dial with adjustable stops. An anti-friction device can be supplied for raising the table so that it can be revolved easily. Universal tilting and revolving tables designed primarily for floor type horizontal boring, drilling, and milling machines are also available. The tops of the latter type tables can be revolved through an angle of 360 degrees, and tilted to any angle up to 90 degrees. 56

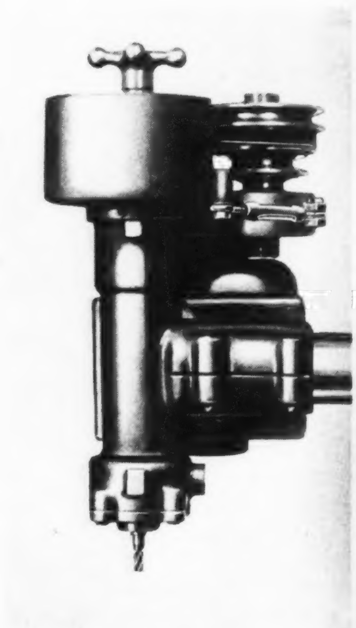


Ohio 30-inch Diameter Table with Four Index-pin Positions and Accurate 1/2-degree Graduations

Indeco Vertical Milling Attachment

A new vertical milling attachment known as the "Indeco," which is said to greatly increase the efficiency of hand milling machines, has been developed by the Syracuse Small Tool & Gauge Co., 107 N. Franklin St., Syracuse, N. Y. This attachment weighs only 60 pounds, and can be easily handled by one man. It is designed for constant high-production use. The spindle has a double radial ball bearing at the upper end and a double preloaded combination thrust and radial bearing at the lower end.

The cutting tools are held by a draw-in collet of 1/2-inch capacity. Four-step pulleys provide spindle speeds of approximately 1590, 1080, 690, and 470 R.P.M. The reduction drive from motor to countershaft is by silent gearing. The drive pulleys are balanced, and there is a belt tension adjuster. The attachment is designed for hand milling machines having over-arms 2 1/4 inches in diameter, but adapters can be provided for use with any milling machine. Power is furnished by a 1/4- or a 1/3-H.P. motor. 57

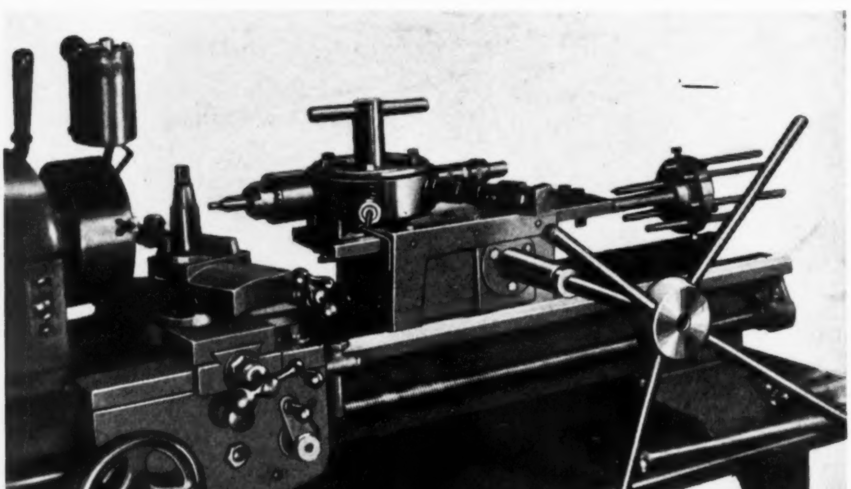


"Indeco" Vertical Milling Attachment

Uhler Lathe Bed Turret

A turret designed for use on small lathes is being placed on the market by the Uhler Mfg. Co., 308 North Ave., Mt. Clemens, Mich. The circular head has provision for six tool stations, the holes being rough-drilled to 7/8 inch, allowing 1/8 inch for finish-boring on the lathe on which the turret is to be used.

The turret is indexed to each position by a lever, an indexing lock serving to lock each tool in its proper position. A tapered indexing pin backed up by a pressure



Lathe Equipped with Uhler Turret

To obtain additional information on equipment described on this page, see lower part of page 184.

ALL № 000's FEATURES FIT INTO TODAY'S LIGHT MILLING REQUIREMENTS
EASY AND QUICK SET-UP
BROWN & SHARPE
Easy Adjustment and Positioning — Transverse, vertical and table reversal
Easy Feed Changes — Pick-off gears
Easy Speed Changes — Pulleys and V-belt
Only One table dog to set
SIMPLE AND RAPID OPERATION
DELIVERIES ARE GOOD
on New No. 000 Plain Milling Machines
We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS
Automatic Cycle — Simply load . . . press starting button . . . await return of table to loading position
Rigidity for reasonable cutting rates
Suitable speeds and feeds for ferrous and non-ferrous materials
BROWN & SHARPE

spring is employed to obtain accurate positioning of the turret. The adjustable tool stops are indexed into position as each tool in the turret-head is brought into its working position. Thus, the depth of cut for each operation is accurately controlled.

The turret-slide has a 5-inch travel, and is fed by means of a turnstile handle. The turret can be equipped with special tools for the manufacture of small parts requiring a number of operations, such as drilling, counterboring, reaming, tapering, etc. 58

Surface Plate Designed to Withstand Heavy Loading

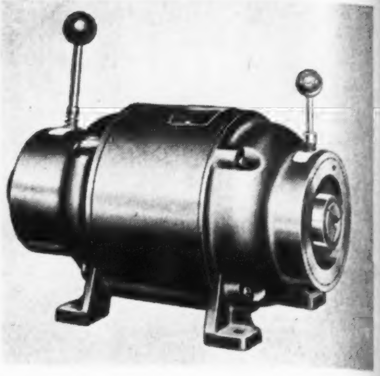
A surface plate designed to support extremely heavy loads without deflection has been developed by the Machine Products Corporation, 6771 E. McNichols Road, Detroit, Mich., to meet the requirements of one of the leading aircraft motor manufacturers. The plate has a depth or thickness of 20 inches, a surface of 4 by 6 feet, and a total weight of more than 2 tons. It is claimed to be the largest surface plate, in point of depth and weight, ever made.

It is made of Meehanite iron, and is thoroughly heat-treated and accurately scraped to meet exacting precision requirements. The plate is mounted on several specially designed pedestal type supports, provided with three adjustable bearings supplemented by adjusting screws which are employed for leveling purposes. Thus, supported at several points, the plate will withstand floor vibration and still remain level. 59

Deepfreeze Chilling Unit

A Model D-70 Deepfreeze two-stage industrial chilling unit has been brought out by the Motor Products Corporation, 2301 Davis St., North Chicago, Ill., which provides a wide range of sub-zero temperatures down to — 70 degrees F. At this temperature it will remove a maximum of 800 B.T.U.'s per hour. The chilling unit is now being used to provide sub-zero cold for testing aircraft instruments and parts, plastics, rubber, and a wide variety of materials used in war production work. It is also being used extensively in the aircraft industry for retarding the aging of aluminum rivets, for storing annealed aluminum alloy metals, and for shrink-fit assembling of parts.

The chilling chamber consists of a double-walled cold cylinder which entirely surrounds the walls of the chilling compartment. The cylinder has an inside diameter of 18 inches and a depth of 30 inches. Although this unit has over 24 square feet of primary freezing surface and a capacity of 33 gallons, it takes up very little space, the over-all height being 37 inches, the length 67 inches, and the width 36 inches. It is operated by a 3/4-H.P., 110-220 volt motor equipped with built-in thermal overload control. 60

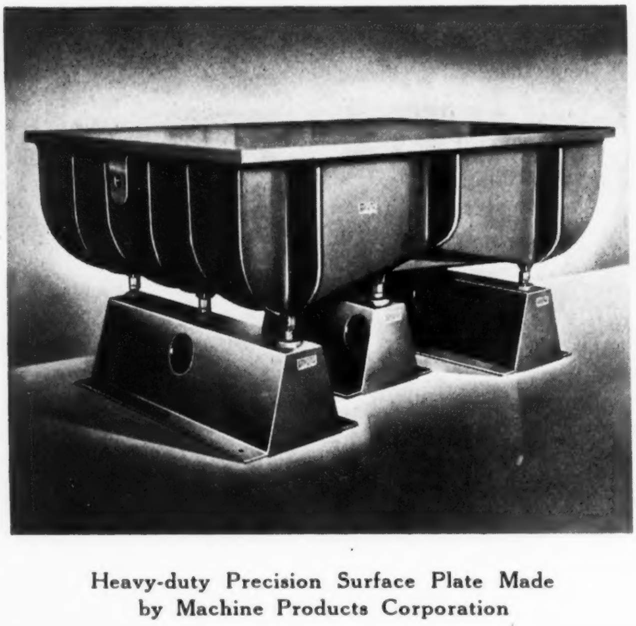


Crozier Polishing Lathe with Hole through Spindle to Accommodate Long Work

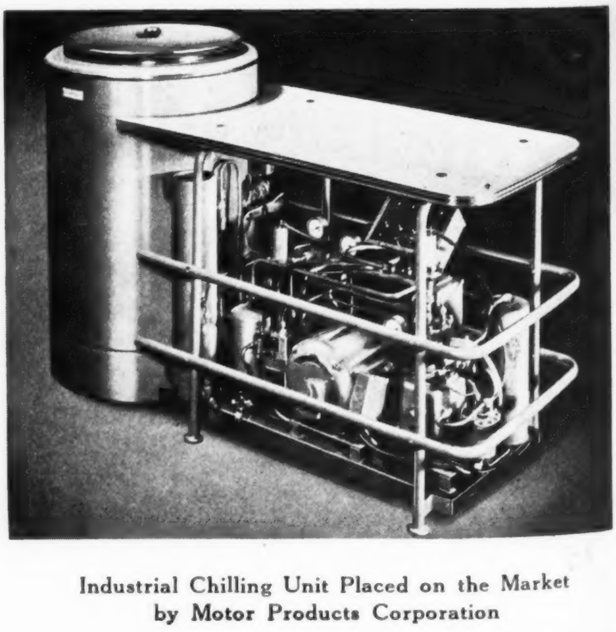
Crozier Polishing Lathe

A polishing lathe with a clearance hole through the spindle that permits polishing any portion of a long piece of work is being manufactured by the Crozier Machine Tool Co., Hawthorne, Calif. This lathe is so designed that it can be loaded and unloaded while the spindle is rotating, a feature that makes it well adapted for rapid-production work. Positive opening and closing of the collet are provided for through a double-face cam-operated mechanism.

Merely turning the hand-grips serves to tighten or loosen the collet tension, no tools being required for making this adjustment. A switch and mechanical brake control can be used for work that can be loaded more easily when the spindle is stationary. The control lever first cuts off the power from



Heavy-duty Precision Surface Plate Made by Machine Products Corporation



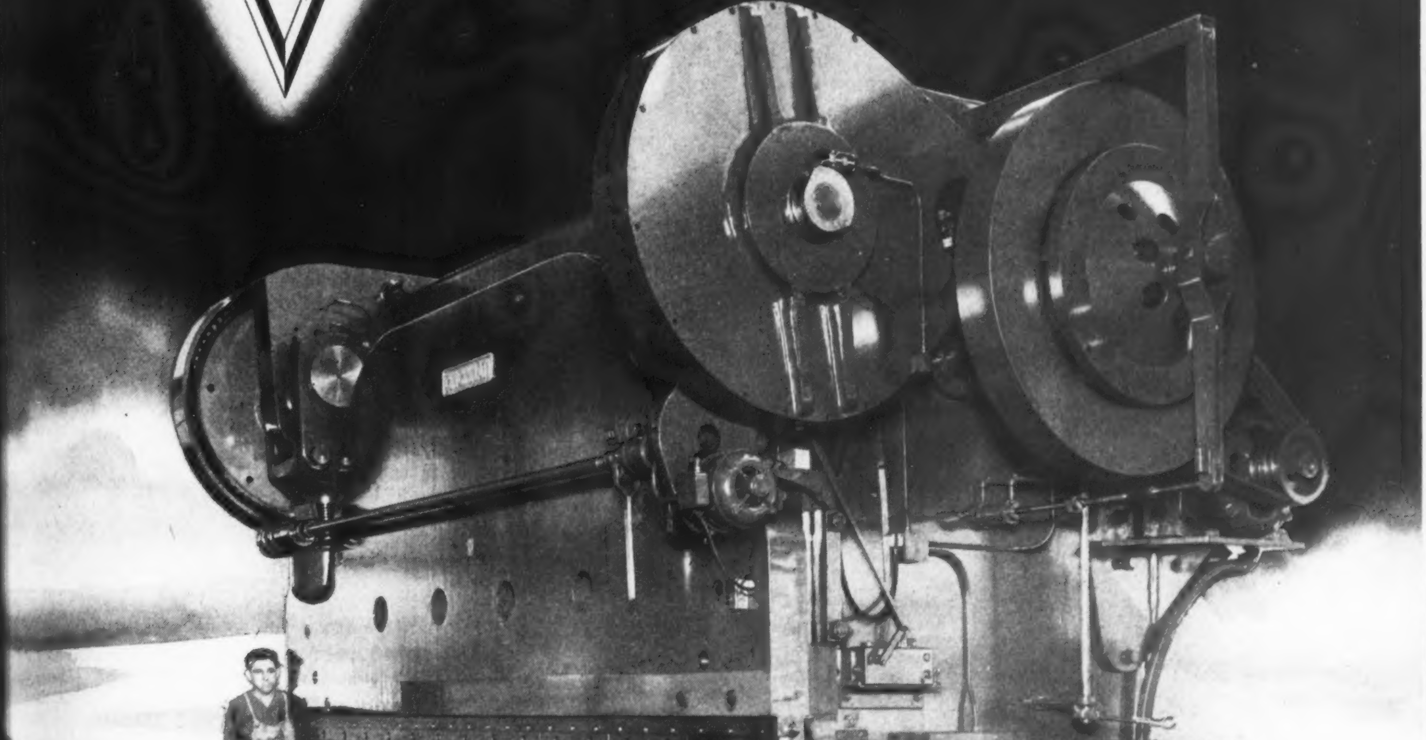
Industrial Chilling Unit Placed on the Market by Motor Products Corporation

To obtain additional information on equipment described on this page, see lower part of page 184.

12 feet of 1 inch plate, *cold*...

or **20** Feet of ¾-inch plate are large capacities . . . But are standard for 500 Series Cincinnati Press Brakes. Day and night, Cincinnati Press Brakes, quickly and accurately, form plates in navy yards, shipyards and other industries for Victory on land and sea. * * * * * * *

Write for CATALOG B-1, illustrating complete line and many uses of Cincinnati Press Brakes



THE CINCINNATI SHAPER CO.

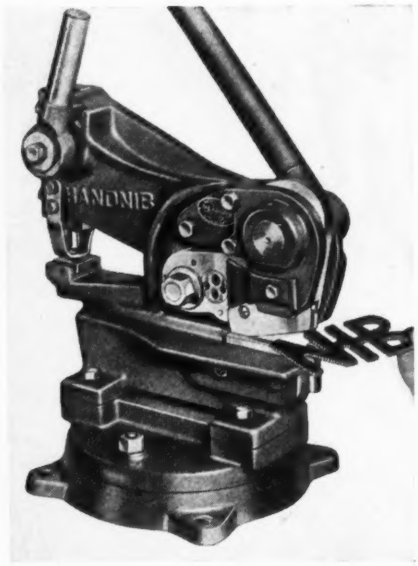
CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

the motor, and then gradually, but firmly, applies a molded disk type brake facing against a cast-iron flange. The entire motor is of dust-tight construction. This lathe is now available in fourteen models varying in horsepower, capacity, and collet arrangements. 61

Nibbling, Shearing, and Punching Machine

A model No. 5 combination nibbling, shearing, drill-rod cutting, and punching machine designed to cut out templets and trial blanks of any shape desired has been brought out by the National Machine Tool Co., Racine, Wis. This machine will cut drill rods 3/16, 1/4, 5/16, and 3/8 inch in diameter. It will punch holes up to 1/2 inch in diameter through flat stock up to 1/8 inch in thickness. 62



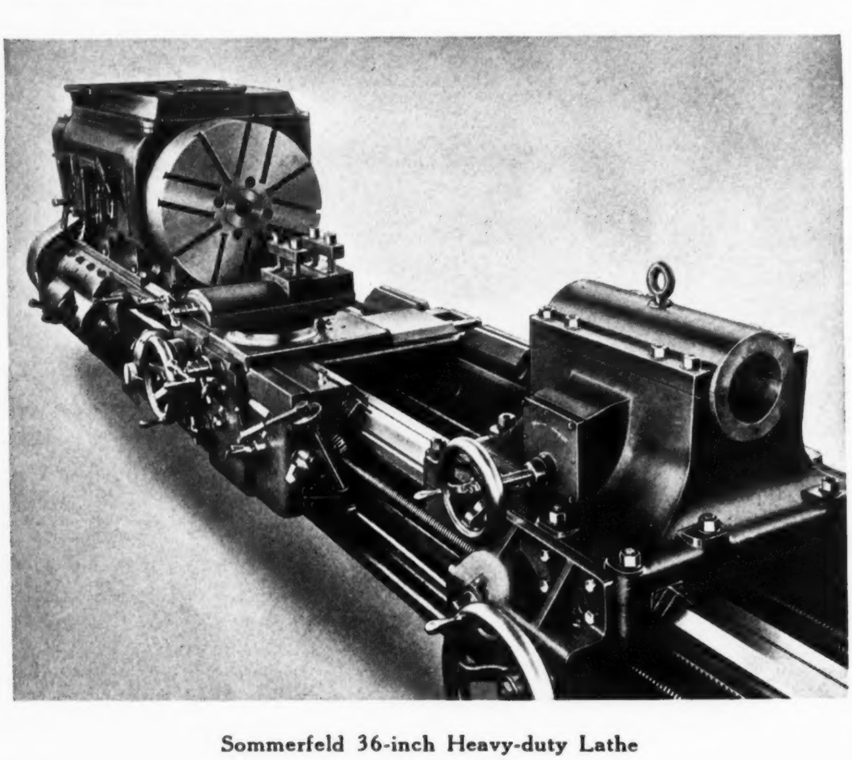
Combination Shearing, Nibbling, Cutting, and Punching Machine

Carbide Tool Grinder Made by Thomas Prosser & Son

Sommerfeld Lathes

The Sommerfeld Machine Co., Braddock, Pa., has brought out two extra heavy-duty lathes of 36-inch and 42-inch capacities to round out its line of machines made in capacities ranging from 27 to 60 inches. The new machines are made in two styles, a Type BT that bores and turns simultaneously, and a Type T for turning only.

These lathes are intended for the rapid production of accurately bored tubes, hollow propeller shafting, and similar work, as well as for the machining of solid parts of any length. They are built for performing fast rough turning, as well as accurate finishing operations. 63



Sommerfeld 36-inch Heavy-duty Lathe

Carbide Tool Grinder

Thomas Prosser & Son, 120 Wall St., New York City, has introduced on the market an improved floor type carbide tool grinder designated Model AA. Improvements incorporated in this grinder include a new heavy base; drum type starting, stopping, and reversing switch; heavier tables; and storage compartment for grinding wheels.

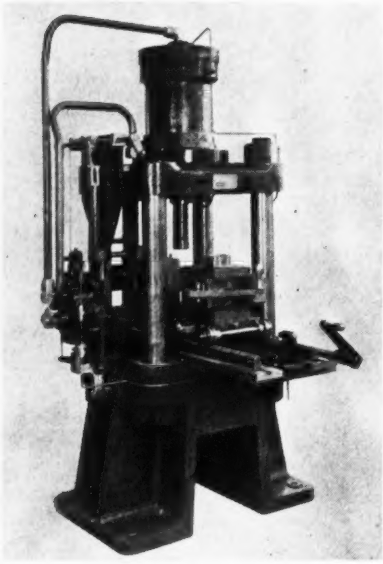
This machine is designed for the rapid removal of metal when rough-grinding, and for the accurate finishing of all single-point tools. Either silicon carbide or diamond wheels, 7 inches in diameter, can be used for grinding carbide tools. Aluminum-oxide wheels can be used for grinding Stellite or high-speed steel tools. A quick-acting indexing device permits setting the table to the desired angle.

Various attachments can be furnished for this machine, such as a device for grinding carbide or high-speed drills of different sizes and a simple arrangement for grinding a lathe tool so that it will break the chips. 64

Magnus Lubricant for Metal-Drawing Operations

The Magnus Chemical Co., Garwood, N. J., has developed a new lubricating compound for coating metal preparatory to press drawing operations. This material is applied as a dip coating to high- or low-carbon steel wire, copper-coated wire, and stainless-steel wire after pickling. It is also used as a lubricant for coating steel parts on which deep-drawing operations are to be performed. 65

To obtain additional information on equipment described on this page, see lower part of page 184.



Hydraulic Press Built by Hydraulic Machinery, Inc.

Hydraulic Press

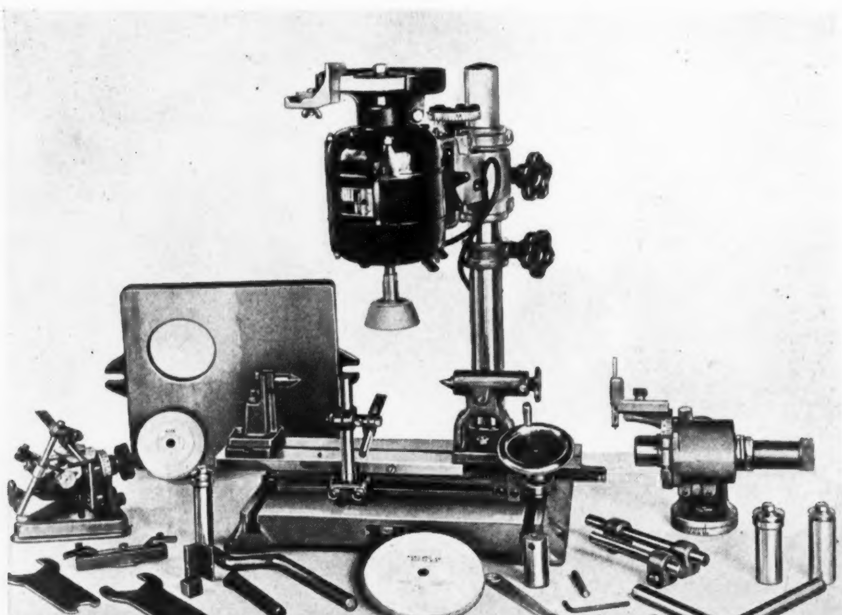
A new type of hydraulic press, built in 25-, 75-, and 100-ton sizes, and that can be adapted to capacities up to 150 tons, is being introduced on the market by Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich. These presses, identified as the K series, are operated by separate motor-driven power units, manually controlled by a four-way valve arrangement, which automatically cuts off the power when the predetermined pressure or tonnage has been reached. The closing speed, power speed, and opening speed are thus accurately controlled according to predetermined specifications. 66

Roan Tool and Cutter Grinder

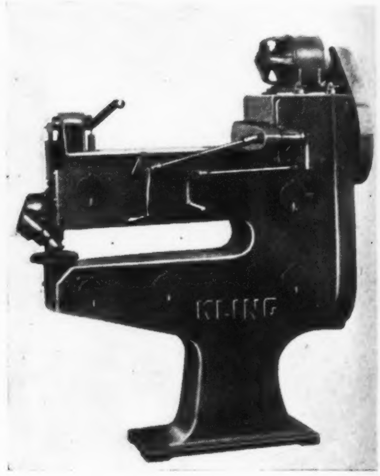
A highly versatile tool and cutter grinder, equipped to handle the grinding of practically all types of milling cutters, is a recent development of the Roan Mfg. Co., 1225 Washington Ave., Racine, Wis. It is adapted for grinding side and face milling cutters, end-mills, tapered or straight reamers with straight or spiral flutes, spotfacers, counterbores, hollow mills, shell type end-mills and staggered-tooth mills, gear and form cutters, and circular saws. It is also suited for contour grinding, and being easily portable, can be employed as a bench grinder.

Graduated adjustments are provided to insure simplicity of operation, fast set-ups, and high-speed precision grinding. The equipment includes a motor grinder head and bracket, which can be raised, lowered, and swiveled, accurate vertical adjustment being obtained by a vernier feed on the motor bracket. The motor itself can be swiveled to bring the grinding wheel into any desired position.

Complete fixtures and accessories are provided to accommodate the various types of tools. These include a precision slide, which can be used independently of the grinder as a bench center for indicating and inspecting tools. There is also a grinding fixture for holding end-mills, milling cutters, and specially formed tools that cannot be held on centers. This unit has a base 18 by 16 inches, a column 25 inches high, and weighs only 175 pounds, complete with all fixtures. 67



Roan Tool and Cutter Grinding Equipment



Rotary Shears for Cutting Mild-steel Plate up to 1 Inch Thick

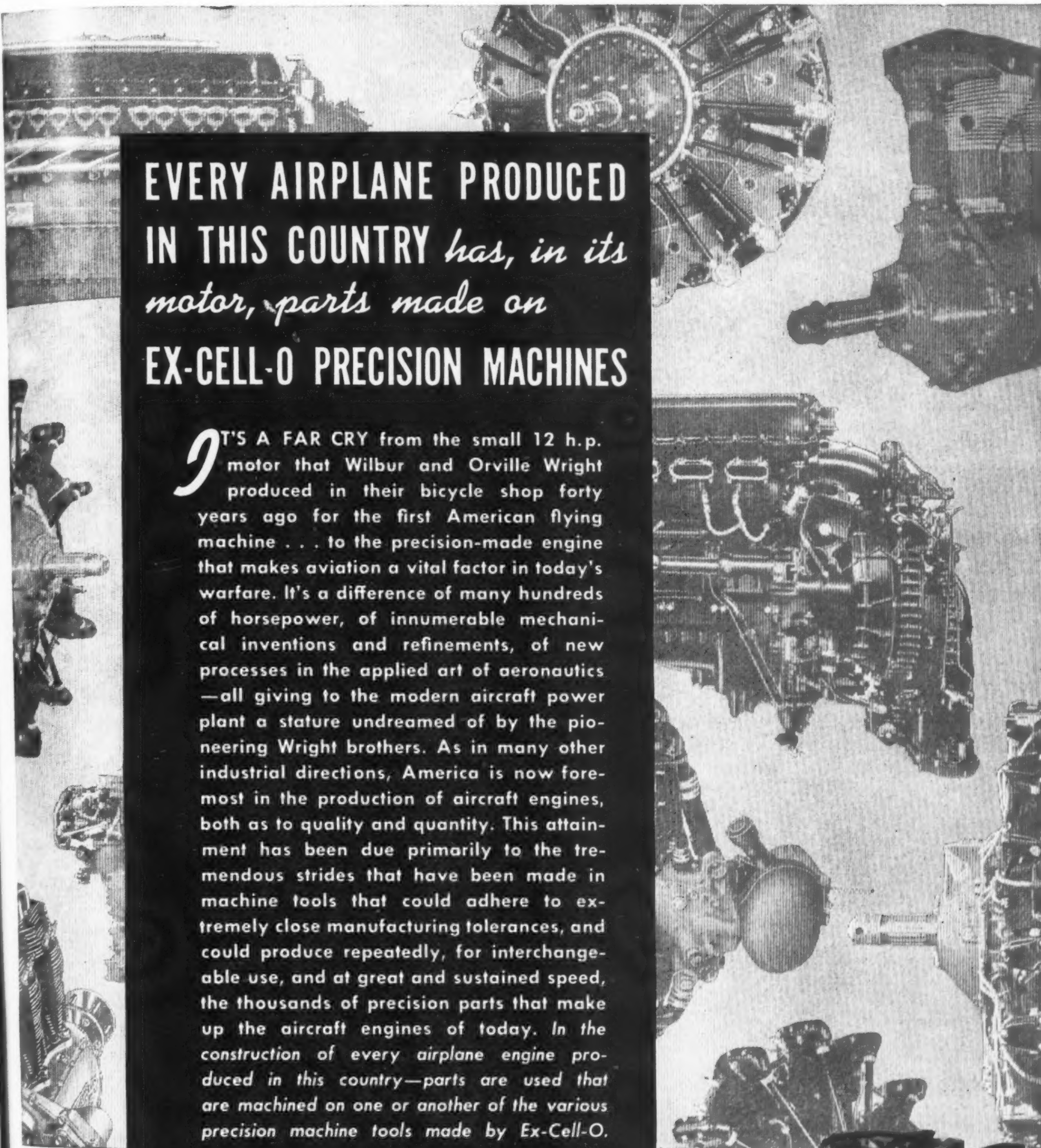
Kling Rotary Shears

A line of rotary shears has been developed by the Kling Bros. Engineering Works, 1300 N. Kostner Ave., Chicago, Ill., to meet the need for machines capable of high-speed precision shearing of sheet and plate material. These rotary shears, when equipped with available attachments, will perform a variety of operations.

One unit is designed to cut along a straight line and to cut openings, circles, odd shapes, strips, flanges, bevels, joggles, and offsets. With this unit it is possible to shear or cut metal pieces to any shape.

The shears can be equipped with rolls for beading, wiring, and various forming operations. They will cut mild-steel plate up to 1 inch thick, and plates of proportionate thickness in other metals. Friction clutches permit shearing speeds to be changed by simply shifting the clutch from one position to another. Cutters are made of oil-hardening tool steel. Adjustment can be made to compensate for wear on the cut-

To obtain additional information on equipment described on this page, see lower part of page 184.



EVERY AIRPLANE PRODUCED IN THIS COUNTRY *has, in its motor, parts made on* EX-CELL-O PRECISION MACHINES

IT'S A FAR CRY from the small 12 h.p. motor that Wilbur and Orville Wright produced in their bicycle shop forty years ago for the first American flying machine . . . to the precision-made engine that makes aviation a vital factor in today's warfare. It's a difference of many hundreds of horsepower, of innumerable mechanical inventions and refinements, of new processes in the applied art of aeronautics—all giving to the modern aircraft power plant a stature undreamed of by the pioneering Wright brothers. As in many other industrial directions, America is now foremost in the production of aircraft engines, both as to quality and quantity. This attainment has been due primarily to the tremendous strides that have been made in machine tools that could adhere to extremely close manufacturing tolerances, and could produce repeatedly, for interchangeable use, and at great and sustained speed, the thousands of precision parts that make up the aircraft engines of today. *In the construction of every airplane engine produced in this country—parts are used that are machined on one or another of the various precision machine tools made by Ex-Cell-O.*

EX-CELL-O CORPORATION • DETROIT, MICH.

To left: **Ex-Cell-O Precision Thread Grinder No. 33 (one of nine Ex-Cell-O styles) widely used in aircraft industry for production of accurately threaded parts. . . . EX-CELL-O precision thread grinders grind fine threads directly from heat-treated blanks and finish grind coarser threads after heat treatment.**

XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

ter-heads. Rapid setting of the cutters to the proper shearing positions is accomplished by an adjustment on the lower cutter-shaft. These rotary shears are made in six sizes, with maximum shearing capacities for plate ranging from 1/8 to 1 inch. 68

Magnus Portable Washing Machine and Degreasers for Cleaning Metal Parts

The Washing Machine Division of the Magnus Chemical Co., Garwood, N. J., has developed a new portable multi-purpose washing machine adapted for cleaning a wide range of large and small metal parts. This new machine is manufactured in three sizes to meet the needs of metal fabricators whose production rates do not warrant the installation of large fully automatic washing equipment.

The machine has several outstanding features, including portability, which permits it to be moved to the point of production or wherever it is needed; choice of three methods of handling work, small or delicate parts being held in baskets, while larger parts are handled individually on the lower platform or are hung on racks in the cleaning solution.

The parts to be cleaned may be either soaked or agitated in baskets or on the lower platform or sprayed with cleaning solution by means of a pump and spray gun. Thus the parts can be soaked in the lower section of the machine and rinsed at the upper level by means of the spray gun. The machine provides for agitation of the parts by an up and down motion, consisting of thirty 8-inch movements per minute. Several types of cleaning solution can be used, the machine being well adapted for the use of an emulsifiable cleaner such as Magnus Emulso-Dip. The machine is equipped with immersed electric heating units that are thermostatically controlled for use with hot alkaline solutions. Chlorinated solvents can also be employed.

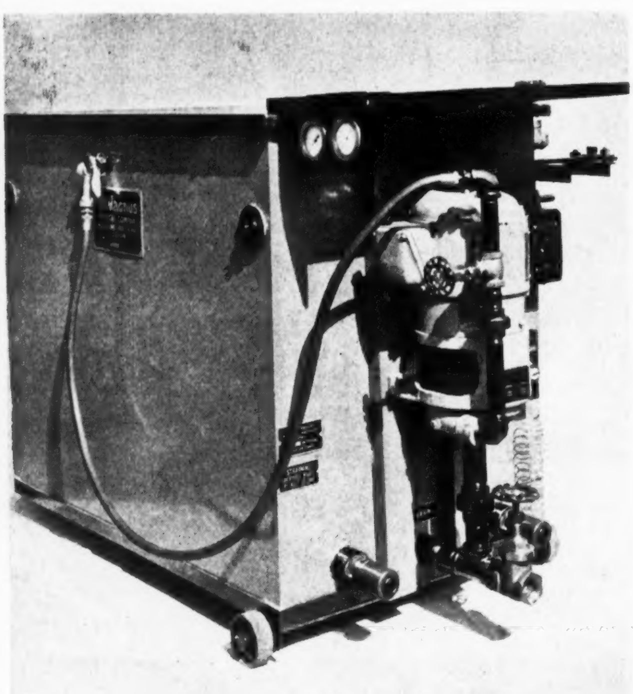
Another recent development of this company in the metal-cleaning field is a line of standard and special vapor and solvent degreasers using inhibited tetrachlorethylene known as Phillsolv. 69

Westinghouse Mot-O-Trol Drive

A new electronic adjustable-speed drive, designated the "Mot-O-Trol," for driving machine tool feeds, winding reels, conveyors, etc., has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This drive provides close feed regulation over a 20 to 1 speed range for direct-current motors that are operated from an alternating-current source.

When the Mot-O-Trol is in operation, the incoming alternating-current power is converted to direct current by thyratron or grid-controlled rectifier tubes. These tubes supply a direct current to the armature and field circuits of the motor. The potentiometer in the control station varies the voltage of the rectified direct current by shifting the phase of the grid-controlled voltage of the thyratrons. Both armature and field circuits, which exercise control over the entire speed range, are adjusted by a dial or dials.

Features of the drive include stepless control; automatic regulation of the speed within close limits where the load requirements are subject to wide variations; full torque at extremely low speeds; smooth stepless acceleration and deceleration; and dynamic braking. This drive is now available in ratings up to 1 H.P. for single-phase operation on 110- or 220-volt 60-cycle circuits. Special drives of larger size can be built. 70



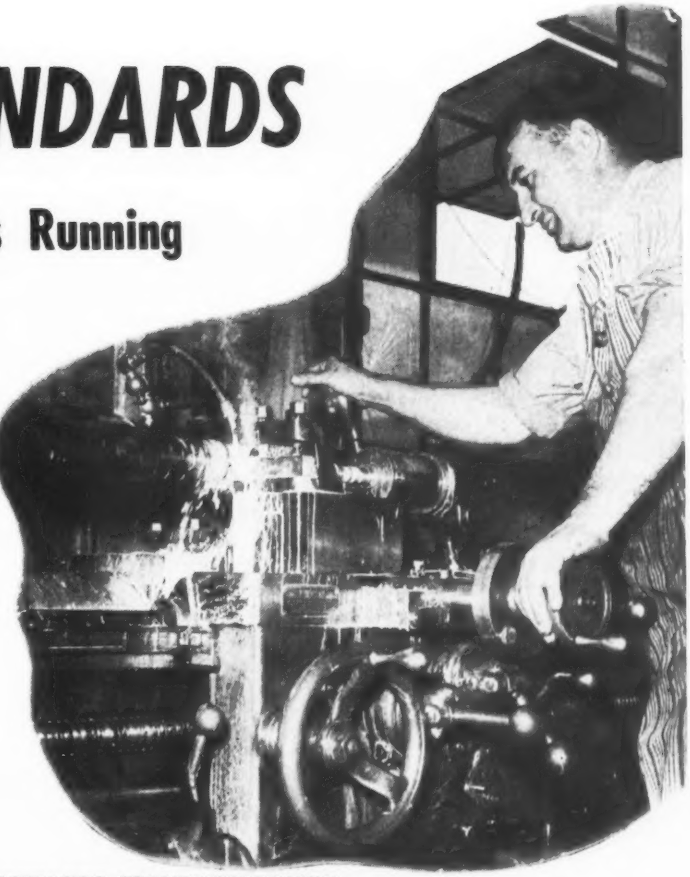
Magnus Portable Multi-purpose Washing Machine

Essential Units of Westinghouse Mot-O-Trol Drive

To obtain additional information on equipment described on this page, see lower part of page 184.

"Switch" to STANDARDS

—and Keep MORE Carbide Jobs Running With LESS Reserve Stocks!



The planned use of *standard* styles of carbide tools and blanks, in place of made-to-order "specials", can bring these important benefits to your plant:

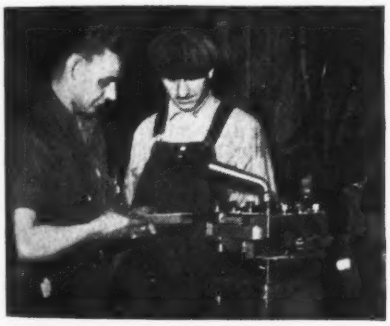
With *standards* you can meet your carbide tool demands more promptly.

With *standards* you can reduce your carbide tool inventory (and still maintain normal tool crib service—even with an increasing use of carbides).

With *standards* you can fill most emergency requirements usually the *same day* the need arises.

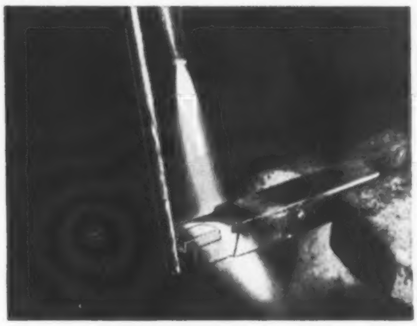
Here is the way to obtain the benefits of carbide tool standardization in your plant:

TAKE THESE THREE STEPS TOWARDS STANDARDIZATION



1 Check your made-to-order carbide tools against *standard* carbide styles. You'll find that just 10 *standard* styles—used either "as is" or quickly adapted by grinding to special shapes—can be used for 50% to 75% of your jobs.

2 Check your carbide tool stocks. With *standards,* you'll no longer need individual reserves for each of hundreds of special styles. Instead, you'll have a flexible master stock based upon not more than 10 *standard* styles.



3 Check your carbide tools that MUST be "specials." Although the tool is special, the blank can often be *standard.* Keep a small master stock of those *standards;* braze them on your tools or cutters the same day the need arises. No "delivery" delays.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

11147 E. 8 MILE BLVD., DETROIT, MICHIGAN

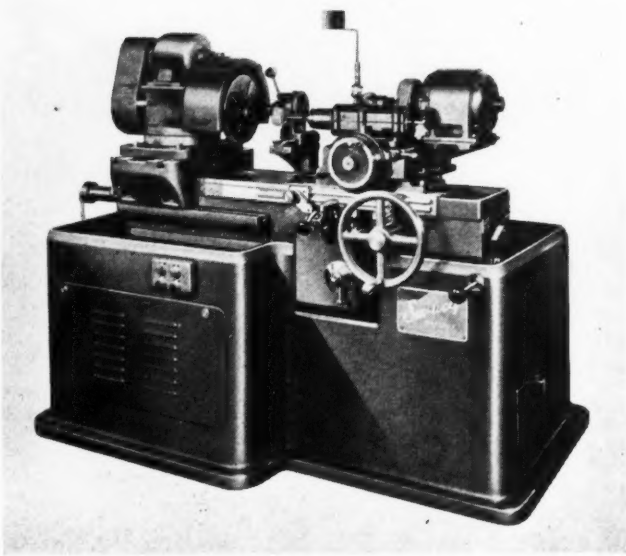
Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada ✓ Standard Catalog GT-142 on request

CARBOLOY TRADEMARK **CEMENTED CARBIDES** TRADEMARK

TOOLS • DIES • DRESSERS • MASONRY DRILLS • WEAR RESISTANT PARTS

Sav-way Internal Grinder



Internal Grinder Brought out by Sav-way Industries

A new internal grinder designed for both hand and hydraulic operation has been brought out by the Sav-way Industries, 4861 E. Eight Mile Road, Detroit, Mich. The hand and hydraulic operating units function wholly independently of each other, although it is possible to use both hand and hydraulic feed in combination on the same job and in the same work setting.

It is claimed that hand operation gives the worker complete control for setting up, and is often preferable for such work as grinding holes of shallow depth, blind holes, and for facing operations. With the hydraulic system, table feeds up to 55 feet per minute are obtainable for use in grinding deep holes. The minimum table stroke is 3/8 inch, and the maximum 24 inches. The machine requires a space 105 by 48 1/2 inches, and weighs 5300 pounds. 71

Automatic Gear and Worm Checking Recorder

A Model B automatic checking recorder is being placed on the market by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. This recorder is designed for use with the Sine-Line lead and involute checkers made by the company for producing permanent chart records of involute tooth forms and lead angles. Once installed, however, it can be applied to a variety of miscellaneous operations such as recording variations in dimensions of gear and thread forms, surface checking with parallels, checking eccentricity of worms and gears, and many other checking operations requiring a precise record of specific dimensions. Only simple changes need be made to provide the required electrical connections between the measuring unit and the recorder.

Michigan Automatic Gear and Worm Checking Recorder

Movement of the electrically operated indicator pen on the chart is magnified in the ratio of 0.0001 inch to 1/8 inch. The over-all width of the chart paper is such that plus or minus dimensional variations up to 0.002 inch either side of the zero line can be recorded. A hinged transparent plastic cover is provided over the chart roll and the recording pen. The entire unit is mounted on rubber-tired casters, and is designed for operation on standard 110-volt, single-phase, alternating-current circuits. 72

Bargar Portable Dust Collector

A portable dust collector known as the Bargar "Safe-Aire" has been developed by the Bargar Sheet Metal Co., Cleveland, Ohio. This equipment is designed to provide a simple, flexible, and inexpensive dust-collection system. It can be used either to supplement larger permanent dust control systems or to serve in place of such systems. Its basic use is to collect dust from a single grinder or other machine, separate the dust from the air, and blow the clean air back into the shop. Normally, it would handle the dust from two 9-inch grinding wheels, whether they are mounted together or separately, and it can be attached to two separate machines. It has a capacity of 600 cubic feet per minute. One of its advantages is that it does not exhaust any air from the shop, but returns it approximately 97 per cent clean and slightly warmer than before. Thus it also effects a saving in heating costs. 73

Electric Drills with Plastic Housings Made by Black & Decker Mfg. Co.

Black & Decker Electric Drills with Plastic Housings

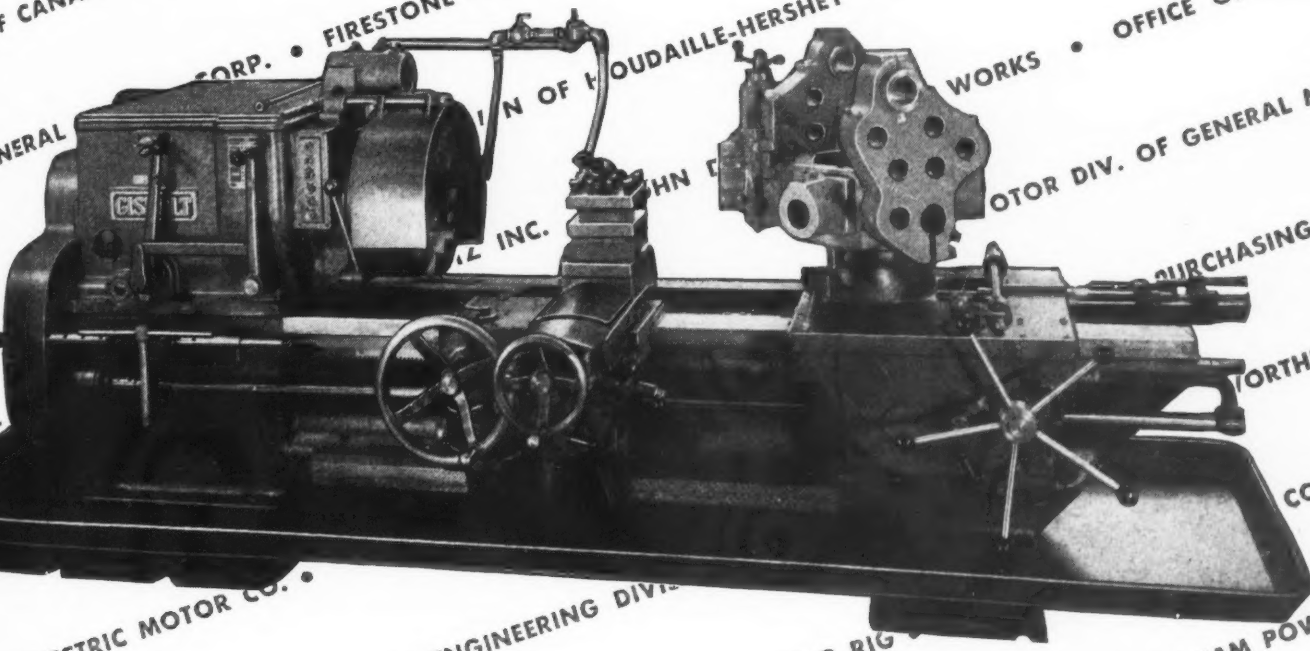
Black & Decker Mfg. Co., Towson, Md., has brought out its 1/4- and 3/8-inch electric drills equipped with housings of new designs made from a plastic material known as

To obtain additional information on equipment described on this page, see lower part of page 184.

AMERICAN BANTAM C...
BUCYRUS ERIE CO. • BU...
...LEHEM STEEL INC. • CANADIAN CAR & FDRY. LTD. • GENELCO LI...
...BROS.—DIESEL ENGINE CO. • CHRYSLER CHICAGO PLANT • CHRYSLER CORP., PLYMOUTH DIVIS...
CROCKER-WHEELER ELECTRIC MFG. CO. • DeHAVILLA...
...ELECTRO-MOT...

...atronage of world-known names *is significant*

...ADIAN WESTIN... • CLEVELAND TRAC... • GENERAL MOTORS CO...
...VELAND PNEUMATIC AEROL • CLEVELAND TRACTOR • DIV. OF GENERAL MOTORS • ...RY CORP. • GENERAL...
...CRAFT OF CANADA LIMITED • DELCO... • FIRESTONE TIRE & RUBBER CO. • INTERNATIONAL HARVESTER
...CORP. • ...OF HOUDAILLE-HERSHEY CORP. • ...WORKS • OFFICE OF LEND-LE...
...OF GENERAL... • ...MOTOR DIV. OF GENERAL MOT...
...NAVY • ...INC. • PURCHASING OF...
...RTH CO. • ...ORTHING...
...CORP.



STAR ELECTRIC MOTOR CO. • HOUDE ENGINEERING DIV... • PARKERSBURG RIG... • WILLIAM POWELL

GISHOLT 3-R AND 4-R SADDLE-TYPE TURRET LATHES

The immediate acceptance of these new Gisholt lathes by leading manufacturers, indicates the sound engineering principles they embody and the important contribution they are making to the war effort.

The Gisholt 3-R and 4-R models are large, saddle-type turret lathes, built in two sizes: 21″ and 24″ chucks; 5¼″ and 9¼″ spindle bores. Literature on request.

VERY EARLY DELIVERIES

GISHOLT MACHINE COMPANY
East Washington Avenue • Madison, Wisconsin

GISHOLT

Look Ahead—Keep Ahead With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

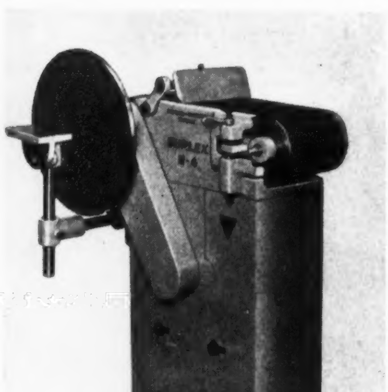
"Drillite." This plastic material, made with a shredded cotton duck base, has a high impact resistance that enables it to withstand considerable abuse and wear. It is heat-resistant, an efficient insulating material, and has a durable, lustrous black finish.

Inserts for mounting ball bearings are cast or molded into the plastic housings, as are also the threaded inserts for assembly screws. One of the chief advantages in using the plastic material is the great reduction in the weight of the complete unit. Both the 1/4- and 3/8-inch drills are available with either end-handle or side-handle control, "pistol grip and trigger" switch, and universal motors, operating on either alternating or direct current. 74

Duplex Abrasive Band and Disk Grinder

The Duplex-M-6 pedestal type grinder recently placed on the market by the Walls Sales Corporation, 96 Warren St., New York City, is furnished with a 3/4-H.P. motor, fully enclosed V-belt drive, balanced steel pulleys, dustproof ball bearings, and Alemite lubricating system and grease gun. Tension on the abrasive band is automatically controlled by a positive acting tension spring.

The bevel attachment can be adjusted to any angle, and always fits close to the grinding table. This machine is furnished with a steel disk, which is removable, and a disk grinding table.

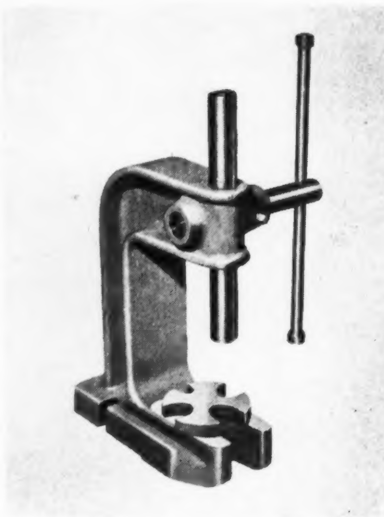


Abrasive Band and Disk Grinder Brought out by the Walls Sales Corporation

The band grinding table is 7 3/4 by 14 inches, the disk grinding table 3 1/2 by 5 inches, and the abrasive band 6 by 48 inches. The disk is 14 inches in diameter, and the drums 5 by 6 1/2 inches. The spindle has a speed of 1450 R.P.M. The machine weighs 500 pounds, and requires a floor space of 20 by 22 inches. 75

Direct-Leverage Hand Arbor Presses

Lempco Products, Inc., 5682 Dunham Road, Bedford, Ohio, has brought out two- and three-ton bench arbor presses designed for smooth, fast, and sensitive operation. A snap ball check, or detent, permits centering the lever so that it can be spun around to bring the ram down quickly into contact with the work. The heavy wrought-steel pressing block has 1 1/8-, 1 5/8-, 1 7/8-, and 2-inch notched openings.



Lempco Hand Arbor Press

The large machined table surface will take work up to 14 inches in diameter. The bearings are machined to reduce friction and lessen wear on the moving parts. This press is especially adapted for disassembling, assembling, bending, straightening, and various pressing operations requiring pressures up to 3 tons. It is made in both bench and wall types. 76

Countersinking Machine Made by the Farnham Mfg. Co.

Farnham Mill Countersinkers

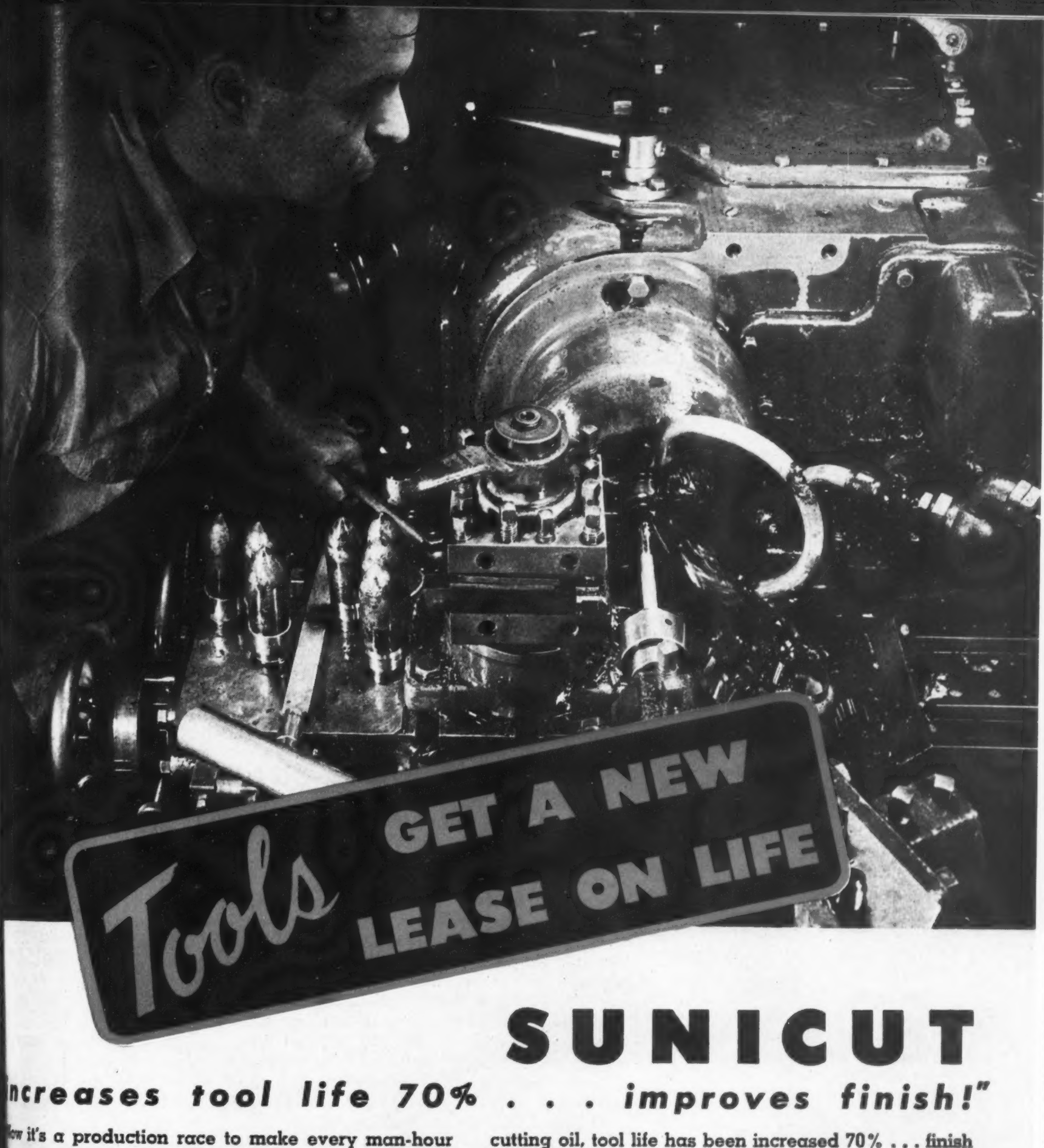
The Farnham Mfg. Co., 1636 Seneca St., Buffalo, N. Y., has announced the development of a complete line of mill countersinkers especially designed for operation by women aircraft workers. The new machines will countersink holes in metal sheets, extruded parts, or assembled metal members. They operate at high speed, and will produce milled countersinks of extreme accuracy with respect to depth and concentricity. These machines can be placed in operation by simply plugging the extension cord into any 110-volt, 50- or 60-cycle, single-phase line and making a connection with the ordinary factory air-pressure line.

Power is furnished by a 1/4-H.P. electric motor and by the normal factory air pressure. By using cutters of different sizes, holes ranging from 3/32 to 3/8 inch in diameter or larger can be machined in sheets up to 96 inches wide by 1 1/4 inches thick. Parts of unusual shape can also be handled on these machines. 77

Welding Electrode with Quickly Replaceable Frostcap Tip

Frostrode Products, 19003 John R St., Detroit, Mich., has brought out a replaceable tip for the refrigerated "Frostpoint" resistance welding electrode made by this

To obtain additional information on equipment described on this page, see lower part of page 184.



SUNICUT

ncreases tool life 70% . . . improves finish!"

ow it's a production race to make every man-hour unt . . . to make every machine produce at maxi-um capacity. And in many plants throughout America nicut has provided the answer!

ke one plant that switched to Sunicut as an example. ey had been using a competitive cutting oil on their es & Lamson turret lathes for turning and threading. ol life was poor . . . finish was not satisfactory. But l of this stopped when a Sun Oil Engineer—one of ose Doctors of Industry—had them change to Sunicut.

w with the superior metal wetting and heat absorb- g qualities of this transparent sulphurized Sunicut cutting oil, tool life has been increased 70% . . . finish greatly improved.

Help your shop get the most finished pieces between tool grinds . . . save tool steel and reduce costly rejects . . . make every man-hour and machine-hour result in peak production. Call in a Sun Doctor of Industry. Let him show you the production value of Sunicut. Remember, his services are yours to help improve the output of your plant. Just write . . .

SUN OIL COMPANY, *Philadelphia*

Sun Oil Company, Limited, Toronto, Canada

SUNOCO

UN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

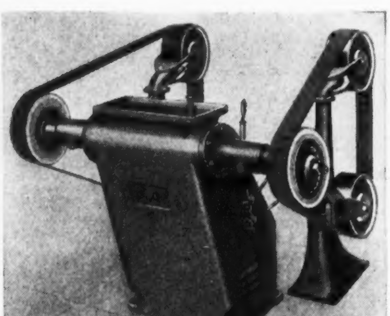
company. The only part that needs replacement in the new "Frostpoint" electrode is the "Frostcap" on the electrode.

To replace the "Frostcap," it is simply necessary to shut off the coolant and grip the cap in a pair of "electric pliers" supplied for the operation. The "electric pliers" melt the solder seal and thus free the cap from the electrode. The cap is then lifted off and a new one slipped into its place. Next the electrodes on the machine are brought together under pressure, causing the cap to be pushed firmly into place. The "electric pliers" are then applied to the new cap to melt the solder and thus complete the seal. Pressure is maintained until the sealer has reset. 78

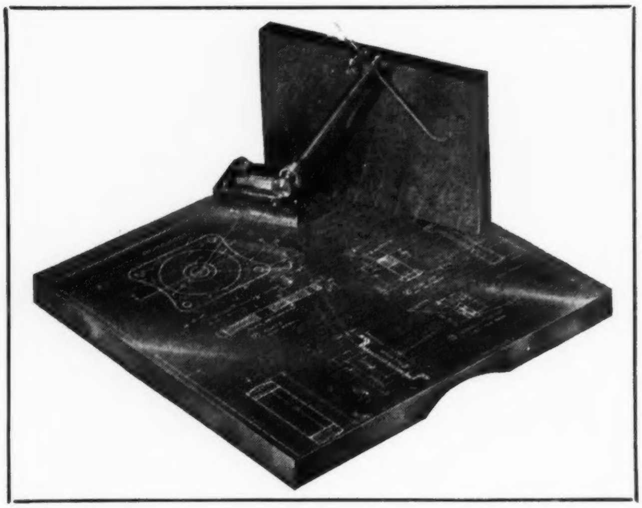
Jones Abrasive-Belt Backstand Idler

A new abrasive-belt, floor type, backstand idler, known as the No. 120, has been developed by the Jones Engineering Co., Ellwood City, Pa. This idler is designed especially for crowded grinding and polishing departments. It can be quickly and easily connected to any grinding or polishing lathe, and requires a minimum amount of floor space.

The backstand will take any belt size up to 6 inches wide, and is designed for belt speeds up to 10,000 surface feet per minute. It is so constructed that simple dust collecting hoods can be easily installed. 79



Abrasive-belt Backstand Idler Built by Jones Engineering Co.



Glass Surface Plate Placed on the Market by the Cadillac Glass Co.

Cadillac Glass Surface Plates

Heavy glass surface plates have been placed on the market by the Cadillac Glass Co., 2570 Hart Ave., Detroit, Mich. These surface plates are available in degrees of tolerances from 0.0002 to 0.0005 inch, and in six sizes, varying from 8 by 8 inches to 18 by 18 inches. The glass surface is very hard, so that wear is negligible. Scratches, unless grouped closely and densely, do not affect the accuracy of the plates. As the scratches do not produce burrs, they will not cause surface errors. Owing to the low coefficient of expansion of glass, there is very little change due to temperature variations. Furthermore, glass surface plates are nonconductors of electricity and do not require demagnetizing, nor do they require oiling of the surface, since they are not subject to corrosion, as is the case with metal plates.

The plates are made from heavy, clear glass, so that drawings or data that is to be referred to frequently may be placed beneath them, thus providing protection for the drawings and making the data readily available. If required, permanent records can be etched on the lower surface of the glass. 80

Metal Spraying Equipment

New equipment for applying a protective metal coating to metal assemblies or structures, for recoating areas burned by welding, and for patching or repairing small areas in large galvanized assemblies where the coating has been damaged has been brought out by the Alloy-Sprayer Co., 2040 Book Bldg., Detroit, Mich. Actual tinning of the sprayed metal is effected with this equipment. Thus, under certain conditions, sandblasting or other extensive preparation of the base metal is not necessary.

The operation consists simply of spraying the surface to be protected with a coating of Galv-Weld metal by means of the new sprayer gun. The latter is portable, and has a thermostatically controlled metal melting pot and means of atomizing and spraying the melted metal. It is operated by air under pressure, in much the same manner as a paint sprayer. A trigger-button on the handle controls the actual spraying. The equipment is light and even when filled with metal, it can be readily manipulated. 81

Adjustable Spacing Collars

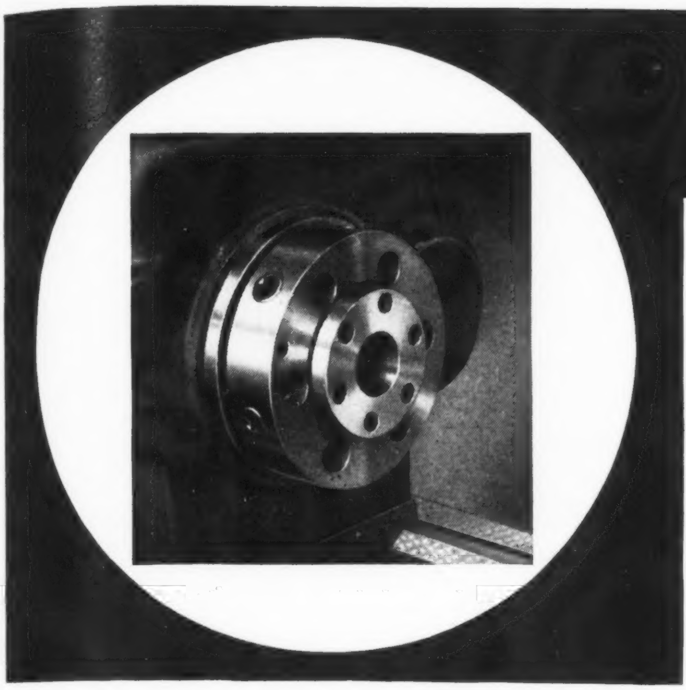
The Dayton Rogers Mfg. Co., 2835 Twelfth Ave. S., Minneapolis, Minn., has placed on the market a new micrometer spacing collar, available in sizes of from 7/8 inch to 5 1/2 inches. This adjustable spacing collar eliminates the necessity for using shims on milling machine cutter-arbors, since it has positive adjustment for spacing cutters on the arbor. Straddle milling cutters, for example, can be accurately spaced by adjusting the

Dayton Rogers Spacing Collars with Micrometer Adjustment

To obtain additional information on equipment described on this page, see lower part of page 184.

SIDNEY

THE SIDNEY MACHINE TOOL CO. SIDNEY, OHIO, U.S.A.



CAM LOCK SPINDLE NOSE

steps up versatility of Sidney Lathes

● Today Speed, Accuracy, Versatility play important parts in stepping up War production to meet urgently needed weapons and equipment. The Cam-lock Spindle Nose recommended for Sidney Lathes has several distinct operating advantages.

The chuck or face plate is mounted on the tapered portion of the nose and driven by accurately fitted pins equally spaced on face of chuck or face plate. These pins, by their cam-locked action, lock the work-holding fixture securely to the spindle.

Also the entire chuck or face plate with work may be removed and further operations completed on another machine, maintaining perfect alignment and accuracy, due to interchangeable feature of locking pins on spindle nose.

Bulletins covering all models available on request.

8–12–16 Speed Models
14"–36" Capacity Range

The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

SIDNEY — ESTABLISHED 1904 — OHIO

collars without removing either the cutters or the collars from the arbor. A special pin type spanner wrench is furnished with each size collar to facilitate quick adjustment of the collar to the plus or minus dimension required. 82

Morey Facing Machine

The Morey Machinery Co., Inc., 410 Broome St., New York City, has developed a self-contained motor-driven facing machine or head especially adapted for facing the ends of long or irregular-shaped pieces that are difficult to handle on a planer. This facing machine can be used to advantage in facing pads or mounting surfaces on large castings that must remain stationary and require a facing head to be brought to the work.

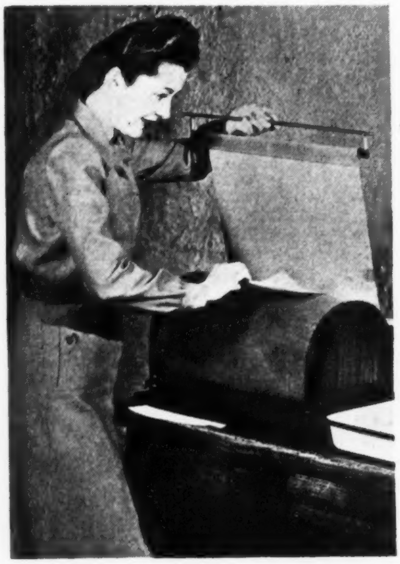
Duplicate facing heads of this kind can be set in fixed positions at right angles or at any desired angle to each other for special machining operations. The 1-inch square cutting tool used is identical to that employed in engine lathes, and can be easily removed for resharpening. A two-way feed is provided so that the cutting tool can be fed away from the center or toward the center. The tool can be returned to the starting position quickly by merely turning the feed-screw backwards by means of a hand-crank.

The machine is equipped with four feed changes ranging from 0.0115 to 0.0460 inch per revolution. Pick-off gears are provided for changing the speed of the head to suit the work. A 7 1/2-H.P. constant-speed motor operating at a speed of 1200 R.P.M. is recommended. A multi- or variable-speed motor can be used to obtain a wider range of speeds. The machine weighs approximately 3375 pounds. 83

Morey Self-contained Motor-driven Facing Machine

Apeco Photocopy Machine

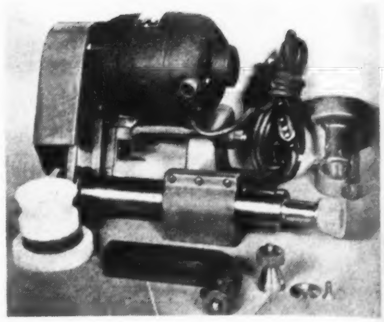
A new Apeco Photocopy machine designed to simplify the making of "photo-exact" copies of anything written, printed, drawn, or photographed has been placed on the market by the American Photocopy Equipment Co., 2849 N. Clark St., Dept. 213, Chicago, Ill. This machine is so designed that no special training or skill is required for its operation. It has very few working operations. The machine can be set up on any desk or table and requires no dark room. Any size copies can be made up to 18 by 22 inches, the copy always being the same size as the original drawing or print. Since the copies are "photo-exact," no proofreading or comparison is necessary. 84



Apeco Photocopy Machine

Lempco Universal Type Toolpost Grinder

A small heavy-duty grinder for internal and external face and taper grinding on lathe, shaper, planer, miller, or bench is a new development of Lempco Products, Inc., 5700 Dunham Road, Bedford, Ohio. This grinder has a capacity for grinding holes 8 1/2 inches deep. It is built to produce mirror-like, commercially perfect finishes. Special adjustment features provide the equivalent of two different quill lengths. The grinding quill has an adjustment of 2 inches, while the motor can be shifted 2 inches on a slide bracket. This saves considerable set-up time on work that ordinarily requires the use of quills of two different lengths.



Toolpost Grinder for Internal and External Grinding Built by Lempco Products, Inc.

The quill assembly is balanced statically and dynamically in four preloaded, matched sets of ball bearings, which are constantly lubricated in a fog oil bath. A one-piece rigid base serves to eliminate vibration. Spindle speeds of 6000 to 13,000 R.P.M. are provided by the two-step V-belt drive. A 5/8-H.P., heavy-duty, high-speed, ball-bearing motor with built-in blower is used. Universal type motors for 25, 50, or 60 cycles, single-phase alternating or direct current can also be used. A wheel guard, diamond dresser, abrasive wheels, and spindle extension are included as standard equipment. 85

Air-Cooled Electrode-Holder

An air-cooled electrode-holder for use on heavy metallic arc-welding jobs, such as the manufacture and maintenance of machine tools, is being placed on the market by Jackson Products, 3265 Wight St., Detroit, Mich. Where rods as heavy as 1/2 inch are used, the intense heat frequently causes the welder discomfort, thus decreasing his efficiency. This insulated heavy-duty holder is cooled by air at from 3 to 4 pounds pressure, which travels the entire length of the lower tong. It is introduced by connecting the air inlet tube to the plant air line.

The holder is made of special

To obtain additional information on equipment described on this page, see lower part of page 184.

...back from danger

Safe on the carrier's deck, the Wildcat returns from a mission of danger! The giant Wasp engine in its nose has roared it to Victory—and brought it back, safe.

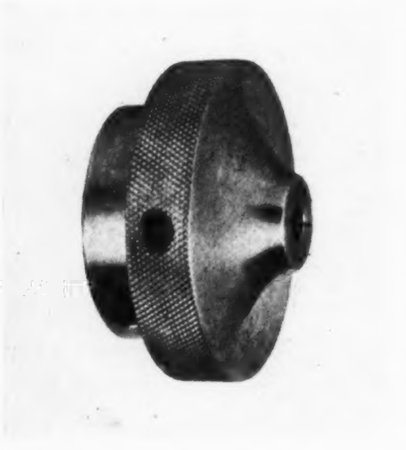
The engineering problems represented by these 18 powerful cylinders are staggering. Take the matter of reduction gears alone. Stepping down the high speed of the whirling crankshaft to the necessary slower propeller revolutions requires gears of such light weight and such extreme precision that only a slight variation would quickly spell their destruction. And yet, the flow of engines coming off production lines to power the world's mightiest air armada demands that these gears be produced by the hundreds of thousands.

And making these gears is Foote Bros.' job—a job that only a few months ago was considered well nigh impossible. How new production techniques—new engineering developments—resulted in the present production that keeps three plants of Foote Bros. Gear and Machine Corporation busy cannot be revealed until the war is won. But when "V" Day comes, these manufacturing know-hows can be applied to the making of precision gears for any product where close tolerances can aid in securing better performance and greater economy.

FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 S. Western Boulevard, Chicago, Illinois

The Grumman Wildcat pictured here has been the Navy's first line fighter since Pearl Harbor. O'Hare, Thatch, Gaylord and other Navy Aces became famous in the cockpit of this tough plane.

high-conductivity copper alloy, with deep-slotted jaws that grip the rod securely and hold it at the correct angle. 86



Otsego Chuck for Bench Lathes

Otsego Collet Chuck for Bench Lathes

Otsego Products, 9214 Otsego Ave., Detroit, Mich., has placed on the market a quick-acting collet chuck designed to increase the range of sizes of stock that can be handled on bench lathes and to save both time and material. No draw-bar is required with this chuck, which will allow bar stock of any size up to 7/8 inch to pass through the headstock spindle. It provides a firm grip for heavy cuts and smooth finish. This chuck is made to fit any bench lathe with a 1 1/2-inch–8 thread on the spindle nose. The collet sizes range from 1/8 to 7/8 inch in steps of 1/16 inch. 87

Tap Releasing Chuck

A tap-holder for use in the turret tailstock of a lathe or on a reversible drill press has been developed by R. E. Uptegraff Mfg. Co., 124 Bridge St., Scottdale, Pa. The stop on the lathe or press is set 1/4 inch in advance of the full travel position of the tap. When the tap has traveled the final 1/4 inch, it is released and runs freely, thus eliminating danger of tap breakage.

When the machine is reversed, the clutch prevents the tap from turning, and therefore causes it to back out. This chuck can be manufactured in different sizes to meet individual requirements. 88

New Army-Navy "E" Awards

The latest additions to the list of companies in the machine-building and allied fields who have been awarded the Army-Navy "E" for outstanding production of war equipment are:

American Foundry Equipment Co., Mishawaka, Ind.

Caterpillar Tractor Co., Peoria, Ill.

Desmond-Stephan Mfg. Co., Urbana, Ohio.

Farrel-Birmingham Co., Ansonia and Derby, Conn., and Buffalo, N. Y.

Foote Bros. Gear & Machine Corporation, Chicago, Ill.

General Electric Co., Bridgeport, Conn., and Erie, Pa., Works.

Leeds & Northrup Co., Philadelphia, Pa.

Morey Machinery Co., Astoria, Long Island, N. Y.

Mullins Mfg. Corporation, Salem and Warren, Ohio.

Geo. D. Roper Corporation, Rockford, Ill.

Whiting Corporation, Harvey, Ill.

Willamette Hyster Co., Portland, Ore.

* * *

Training Carbide Tool Supervisors

The Carboloy Company, Inc., Detroit, Mich., has published a twelve-page booklet on its factory-operated training course for carbide tool supervisors in industrial plants. This course, which has been in operation for about three years, covers the fundamentals involved in the design and application of carbide tools, including the brazing and grinding of such tools and tool-handling practice.

The booklet also contains suggestions as to the types of men best suited for training to become carbide tool supervisors in industrial plants.

* * *

The Alien Property Custodian of the United States has announced that 50,000 patents formerly owned by residents of enemy and enemy-occupied countries are available for use by American industry. Further information can be obtained from the Office of Alien Property Custodian, Chicago, Ill.

Jackets for Protecting Finished Parts

A jacket or boot that conforms to the shape of highly finished parts has been developed by the Metal Textile Corporation, Orange, N. J., for the protection of highly finished or fragile parts while in process in a factory or while being packed for shipment. This protective jacket has an outside sleeve of composite steel-and-cotton mesh, with an interlining of all-cotton mesh. This construction protects the parts from metal-to-metal contact, retains the oil film, and excludes dust and dirt, which may cause scratches. These jackets conform closely to the contour of the parts, and can be used over and over again. They are furnished in diameters and lengths as required.

* * *

Reconditioning Welding and Flame-Cutting Tips

A time-saving method for reconditioning brass or copper gas-welding and flame-cutting tips has recently been devised by Oakite Products, Inc., 26 Thames St., New York City. With this method, 500 tips have been cleaned in three hours, which cuts in half the time previously required for this work and doubles the number of tips available. Only one man is required for the reclaiming work. Complete details concerning the new method are incorporated in a field service report issued by Oakite Products, Inc., which can be obtained on request from the company.

* * *

Reclaiming Cylinders by Chromium Plating

On a war product made by the Westinghouse Electric & Mfg. Co., East Springfield, Mass., chromium plating is being used in reclaiming cylinders. The requirements of accuracy in the size and smoothness of finish of the cylinder bore usually resulted in a considerable scrap loss. By the chromium-plating method, in a three months' period, the plant has reclaimed 203 cylinders, and has saved 1400 pounds of critical material and more than $1000 in cost.

To obtain additional information on equipment described on this page, see lower part of page 184.


AMERICA'S HEADQUARTERS FOR
MOUNTED WHEELS
SMALL GRINDING WHEELS

News of the Industry

Illinois and Indiana

Neil C. Hurley, Jr., was elected executive vice-president of the Independent Pneumatic Tool Co., Chicago, Ill., at a recent meeting of the board of directors. He has been associated with the company for eleven years, the last four of which he has served as vice-president and director. John A. McGuire was elected secretary, and E. R. Wyler was named vice-president with headquarters in New York City. All other directors and officers were re-elected.

Kropp Forge Co., Chicago, Ill., was recently awarded the second white star for the Army-Navy "E" flag previously presented to the company for excellence in production of war materials. A star is added for each six months' renewal of the production award.

Copperweld Steel Co., Warren, Ohio, announces the opening of a new sales office at Indianapolis, Ind. M. A. Williams has been appointed district sales manager of this office, with headquarters in the Circle Tower. The territory covered will include central and southern Indiana, southwestern Ohio, and the state of Kentucky. Mr. Williams was formerly Indianapolis-district sales manager for the Republic Steel Corporation.

Frank S. O'Neil, general manager of the Indianapolis plant of the Link-Belt Co., has been promoted to the position of vice-president. He will take the place of James S. Watson, who is retiring from active duty at the end of this year, upon the completion of fifty years of service. Mr. Watson will continue to serve as a director of the company. Mr. O'Neil's headquarters will continue to be at 220 S. Belmont Ave., Indianapolis, Ind.

Florida and Georgia

R. S. Elberty, Jr., 120 E. Broward Blvd., Fort Lauderdale, Fla., has established himself as a consulting engineer, specializing in the design and styling of machinery and in electrical drives for automatic operation. Mr. Elberty has worked as development engineer for the American Laundry Machinery Co., as chief engineer for the B. A. Wesche Electric Co., as industrial application engineer for the Westinghouse Electric & Mfg. Co., and as electrical and assistant chief engineer for the Landis Tool Co. He has also been connected with the T. W. & C. R. Sheridan Co. in the conversion of their plant to war work and in other development work.

R. S. Elberty, Jr., Now Engaged in Consulting Engineering Practice

C. B. Rogers, 1000 Peachtree St., N.E., Atlanta, Ga., has been appointed representative of the Ajax Electric Co., Inc., Philadelphia, Pa., in the states of Tennesee, Georgia, South Carolina, Florida, Alabama, and Mississippi.

Michigan

G. C. Brown has been appointed Detroit engineering representative for the Aircraft Screw Products Co., Inc., Long Island City, N. Y., licensor of the "Aero-Thread" screw thread system. Mr. Brown was previously sales engineer for the Bohn Aluminum & Brass Corporation, producer of aluminum and magnesium castings, and the Dow Chemical Co., producer of magnesium alloy castings.

Ted Nagle has been appointed sales promotion and advertising manager of Sav-way Industries, Machine Tool Division, Detroit, Mich. Mr. Nagle was previously president of his own company—the Ted Nagle Equipment Corporation, manufacturer of automotive equipment and electric chassis dynamometers. Prior to that, he was connected with General Motors and the Bendix Aviation Corporation.

Dettary Engineering Co. has acquired and moved into a plant at 4222 Second Ave., Detroit, Mich., where approximately 5000 square feet of floor space is available. The company is engaged in the design and building of jigs, fixtures, tools, and dies. Steve Dettar is the owner of the plant, and B. H. Randall, plant manager.

Fred G. Howell, formerly manager of the Detroit branch of the Producto Machine Co., has been elected vice-president of the Producto Corporation, 3017 Medbury Ave., Detroit, Mich.

Allied Tool & Engineering Co. announces the removal of its office and factory to a new plant at 8832 Van Dyke Ave., Detroit, Mich.

Roller Tool Co. announces the removal of the company from 3015 E. Milwaukee Ave., Detroit, Mich., to 319 Orleans St., Detroit.

Mid-West Welding Works announce the completion of their new plant at 8925 Gratiot Ave., Detroit, Mich.

New England

Wilson F. Howard has been appointed representative in charge of the Connecticut district for the Machinery Division of the Austin-Hastings Co., Inc., Cambridge, Mass., machine tool distributor. Mr. Howard has been associated with the machine tool field for the last twenty-five years, and pre-

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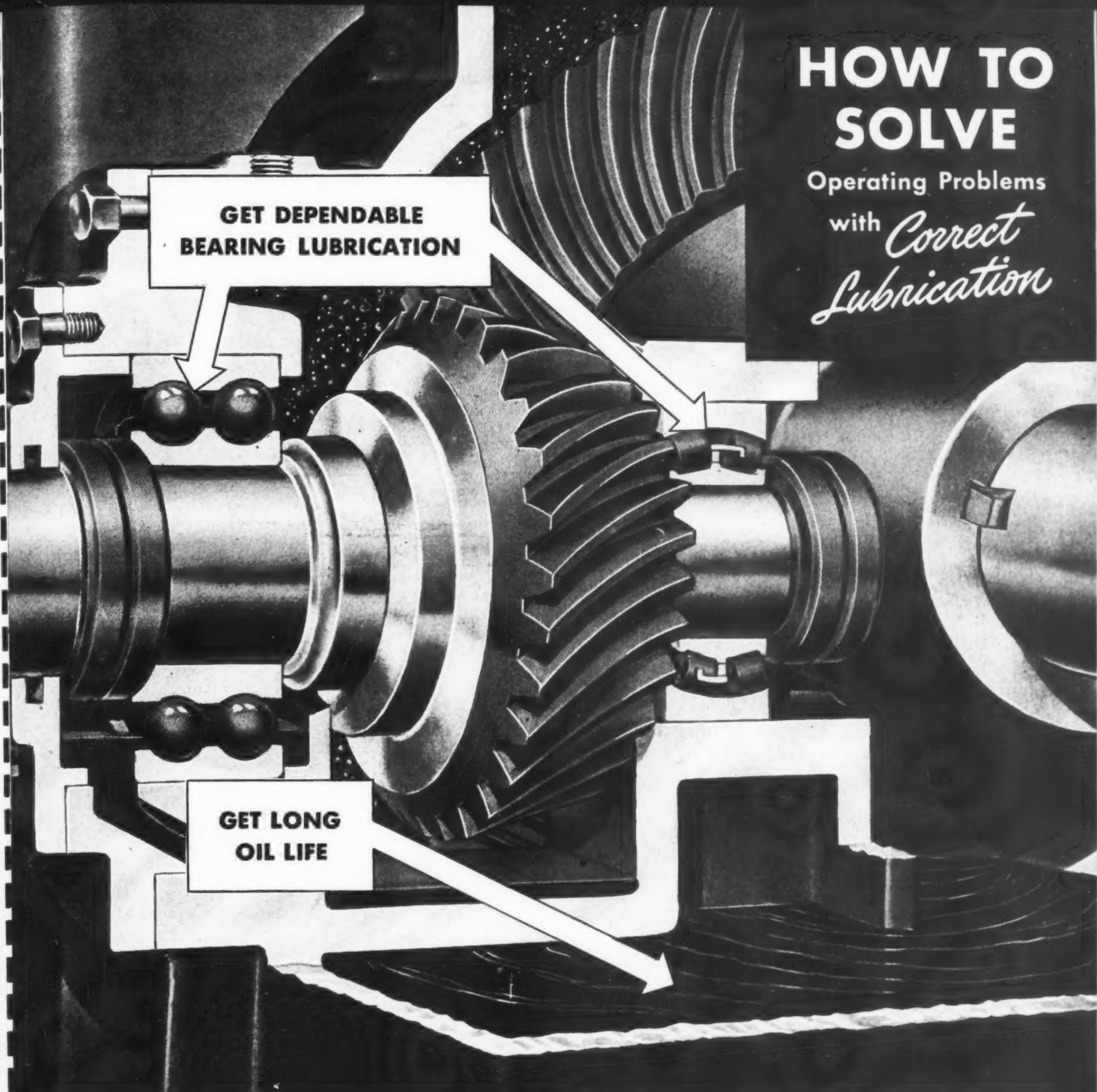
Wilson F. Howard, Connecticut Representative, Machinery Division, Austin-Hastings Co.



HOW TO SOLVE

Operating Problems with *Correct Lubrication*

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

Reduce Wear — Get a *Plus*, too

OF COURSE YOU WANT gear tooth wear kept to a minimum! Gargoyle Vacuoline Oil will help you do that in a splash or circulation oiling system. It forms an oil film of high lubricity and great strength.

But can you get more, too? What about the LIFE OF THE OIL? Does the oil you use separate easily from water? Is it free from emulsions and sludge? WHAT ABOUT THE BEARINGS? Does the oil you use protect them from damaging rust?

Here's the point: Gargoyle Vacuoline Oil does not only minimize wear. *It also minimizes rusting danger* in the bearings. *And it lasts long.*

Yes, by all means, *insist* on an oil that reduces tooth wear—but get the "plus" of long bearing life, long oil life by using Gargoyle Vacuoline Oil.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

CALL IN SOCONY-VACUUM

vious to his new connection was shop manager of the Jones & Lamson Machine Co., Springfield, Vt. His headquarters will be at 1800 Park St., Hartford, Conn.

FRANK J. COUGHLIN has been appointed purchasing agent of the Pratt and Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Mr. Coughlin completes thirty years of continuous service with the company this year, and has been assistant purchasing agent since 1928. He succeeds HOWARD H. WALLACE, who has been forced to relinquish his duties because of ill health.

Frank J. Coughlin, Purchasing Agent, Pratt & Whitney Division Niles-Bement-Pond Co.

ELLSWORTH BRASH, III, has been appointed district representative for the Allen Mfg. Co., Hartford, Conn., covering Pennsylvania and the state of New York, with the exception of New York City and Long Island. Before joining the Allen organization, Mr. Brash was associated with the W. O. Barnes Co., Inc., of Detroit.

E. C. BULLARD, vice-president and general manager of the Bullard Co., Bridgeport, Conn., maker of vertical turret lathes and Mult-Au-Matics, completed his twenty-fifth year with the firm on March 18. He was guest of the Bullard Foremen's Club at a dinner attended by two hundred members and friends.

JOSEPH C. BABCOCK, foreman in the drill grinding department of the Morse Twist Drill & Machine Co., New Bedford, Mass., was recently the guest of honor at a testimonial dinner given by W. T. READ, president and treasurer of the company, upon the occasion of Mr. Babcock's retirement after serving the company for nearly sixty-one years. About fifty fellow foremen and associates attended the dinner, which was given at the New Bedford Hotel, and Mr. Babcock was presented with a double service pin for his amazing record, which has never been equalled before in the history of the company. He was also presented with a substantial financial gift.

Joseph C. Babcock, Who has Just Retired after Sixty Years' Service with Morse Twist Drill & Machine Co.

HELGE G. HOGLUND, for the last ten years sales manager of the Machine Tool Division of the Van Norman Machine Tool Co., Springfield, Mass., has been appointed vice-president. He will continue to be in charge of sales of the Machine Tool Division, and in addition, will have control of sales of the new Electronics Division, which is manufacturing induction heating equipment. Mr. Hoglund is a graduate of the Purdue University School of Engineering. Prior to joining the Van Norman organization, he was associated for ten years with the General Electric Co. as manufacturing, production, and sales engineer.

Helge G. Hoglund, New Vice-president of the Van Norman Machine Tool Co.

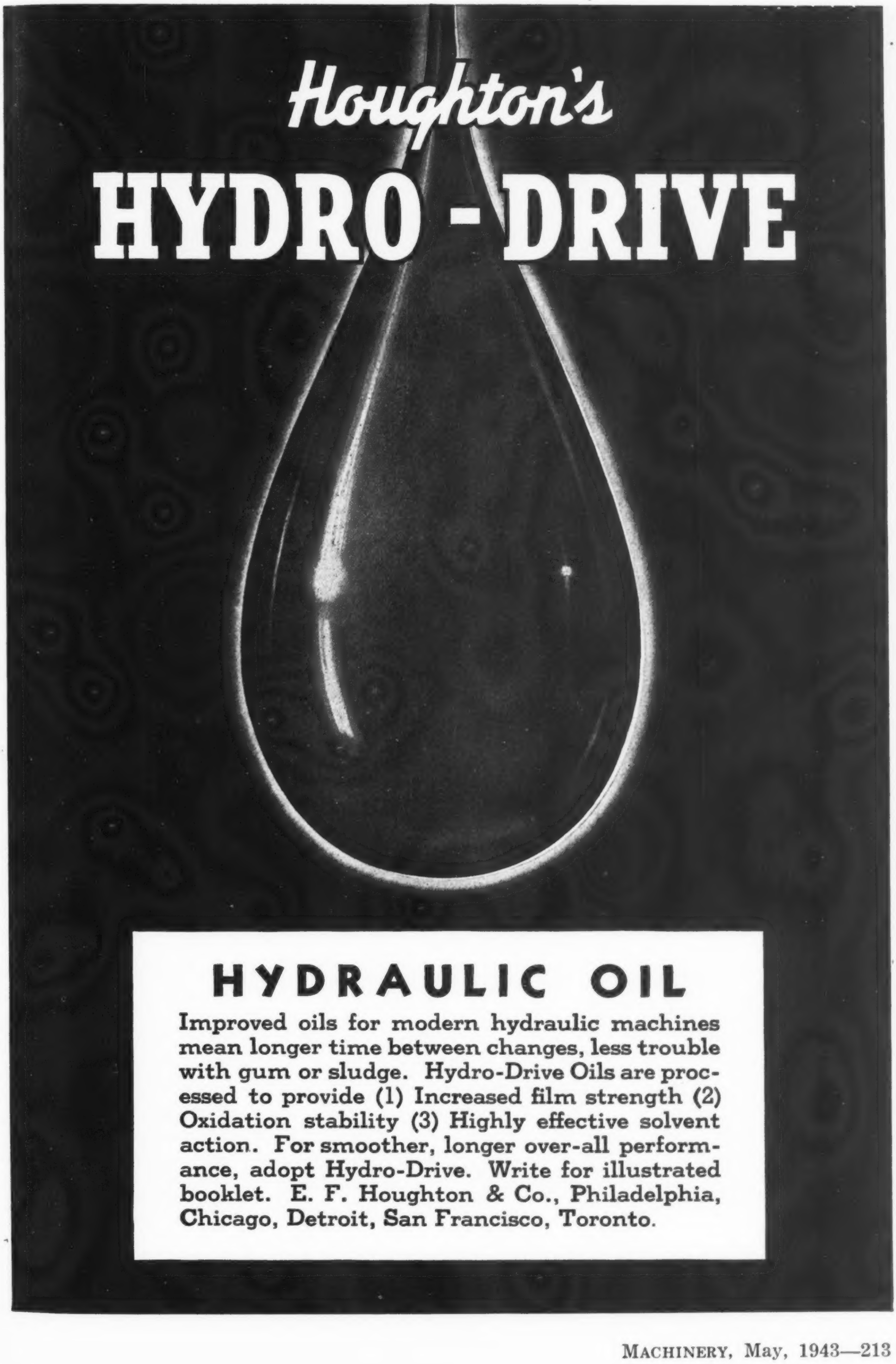
New Jersey

GILBERT L. DANNEHOWER has been appointed sales manager of the Swiss American Gear Co., Jersey City, N. J., manufacturer of precision gears. Mr. Dannehower will also manage the sales of the Cosa Corporation, Chrysler Bldg., New York City, importer of Swiss precision machinery. From 1914 to 1919, Mr. Dannehower was general manager in the United States for Johansson of Eskilstuna, Sweden, manufacturer of precision gage-blocks, and for the last four years has been with the Walker-Turner Co., Inc., of Plainfield, N. J.

© Benson Studios

G. L. Dannehower, New Sales Manager of the Swiss American Gear Co.

DR. CHARLES M. SLACK has been appointed assistant director of research at the Westinghouse Lamp Division, Bloomfield, N. J. Dr. Slack is well known in the field of electronics research and for his contributions to the development of an ultra high-speed X-ray machine that is making possible wartime studies of bullets as they crash through armor plate. In his new position as assistant to Dr. Harvey C. Rentschler, research director, Dr. Slack will direct experimental work on various lamp and electronic problems. Additional responsibilities have been assigned to DR. JOHN W. MARDEN, who has been assistant director of research


Houghton's
HYDRO-DRIVE
HYDRAULIC OIL
Improved oils for modern hydraulic machines mean longer time between changes, less trouble with gum or sludge. Hydro-Drive Oils are processed to provide (1) Increased film strength (2) Oxidation stability (3) Highly effective solvent action. For smoother, longer over-all performance, adopt Hydro-Drive. Write for illustrated booklet. E. F. Houghton & Co., Philadelphia, Chicago, Detroit, San Francisco, Toronto.

for the last fifteen years. Although continuing in his present position, Dr. Marden will assume complete charge of metals research, an activity that has expanded greatly since the outbreak of the war.

ELECTRIC ARC, INC., Newark, N. J., has just celebrated its twenty-fifth anniversary, having been organized in March, 1918, when the company took over the patents of C. J. Holslag from the Steinback Electric Co., Peekskill, N. Y. Electric Arc, Inc., has been a pioneer in alternating-current welding. Its newest development is the "group multiple star system," in which the arc starts on direct current, but continues on alternating current.

H. L. TREMBICKI has been appointed manager of the newly organized Wire Coating Division of the Magnus Chemical Co., Inc., Garwood, N. J.

New York

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that, in order to help industry with electronic application problems, eighteen industrial electronic specialists have been appointed to serve in various offices of the company throughout the country. Appointments are as follows: I. C. DIEFENDERFER and D. C. HIERATH, New York City; J. F. GETZ, Philadelphia; A. J. MOORE, Boston; W. B. FRACKELTON, Chicago; L. E. DONAHUE, Los Angeles; J. A. SETTER, Denver; I. F. CONRAD, St. Louis; A. D. BOARDMAN, San Francisco; L. B. PARSELL, Detroit; L. R. ELDER, Portland, Ore.; FRANK C. NEAL, JR., Dallas; R. H. JACKSON, Atlanta; K. H. KELLER, Cleveland; R. C. NORRIS, Cincinnati; A. M. DAWSON, Pittsburgh; B. COGSWELL, Buffalo; and L. F. STONE, Newark.

J. J. MCINTOSH has been appointed southeastern sales representative of Greene, Tweed & Co., 4377 Bronx Blvd., New York City, manufacturers of mechanical packings, Basa softface hammers, and reversible ratchet wrenches. B. F. COOMBS has been appointed Texas sales representative of the company. Mr. McIntosh's territory will include the states of Alabama, Florida, Georgia, Mississippi, North and South Carolina, and Tennessee east of the Tennessee River. His headquarters will be at 1106 McLynn Ave., Atlanta, Ga. Mr. Coombs will cover Texas and western Louisiana, and his headquarters will be in Houston, Tex. (Route 12, Box 495).

MEEHANITE METAL CORPORATION and the MEEHANITE INSTITUTE OF AMERICA, INC., announce the removal of their headquarters from Pittsburgh, Pa., to the Pershing Bldg., New Rochelle, N. Y. The new headquarters will afford enlarged laboratory and research facilities, and will permit the rendering of improved service to industrial users of Meehanite castings, as well as to the members of the Meehanite Research Institute.

WALTER W. BROWN, engineer in the transportation department of the General Electric Co., Schenectady, N. Y., has been given a citation of individual production merit — the highest honor that the nation bestows on essential war workers. The citation was given to Mr. Brown by the War Production Board in recognition of his accomplishment in redesigning army searchlight cable couplers.

ALFRED P. SLOAN, JR., chairman of the board of directors of the General Motors Corporation, Detroit, Mich., has recently been named chairman of the National Industrial Information Committee of the National Association of Manufacturers, succeeding J. HOWARD PEW, president of the Sun Oil Co., of Philadelphia.

DR. IRVING LANGMUIR, associate director of the General Electric Research Laboratory, Schenectady, N. Y., has been elected to honorary membership in the Institute of Metals, London, England. Dr. Langmuir, in 1932, was the winner of the Nobel prize in chemistry.

DR. ANCEL ST. JOHN has been granted a leave of absence from the St. John X-Ray Service, Inc., Long Island City, N. Y., in order to aid the Ordnance Department, Washington, D. C., as senior metallurgist.

C. W. HIGBEE has been made manager of the newly organized wire and cable department of the United States Rubber Co., Rockefeller Center, New York City. Mr. Higbee was previously manager of wire sales.

VIBROSCOPE, INC., manufacturer of Davey vibrometers and portable balancing equipment, announces that the company's factory and office was moved on May 1 from 6 Varick St., New York City, to 6 E. 39th St.

TURL IRON & CAR CO., INC., Newburgh, N. Y., manufacturer of merchant marine equipment, has been given the Maritime Commission's "M" award of merit for outstanding production performance.

STANDARD MFG. CO., Corning, N. Y., has changed the name of the organization to the HUNGERFORD CORPORATION, and has moved into a new plant in Big Flats, N. Y.

GLYCO PRODUCTS CO., INC., Brooklyn, N. Y., announces that it has moved its administrative offices from 230 King St., to larger quarters at 26 Court St.

Ohio

LINCOLN ELECTRIC CO., Cleveland, Ohio, manufacturer of arc-welding equipment, announces the following changes in office addresses and personnel of the application engineering organization of the company: The address of the Duluth office is now Room 200, Builders' Exchange Building, Duluth, Minn. H. H. STAHL, of the Philadelphia office, has been transferred to Boston, where he will serve as district manager of that area, in addition to continuing his welding application work; R. J. SHEPHERD, formerly of the Toledo office, is now in Philadelphia; C. M. RICHARDSON, of the Moline office, has been transferred to the Toledo office as application engineer and district manager; and W. J. BARRETT, previously with the Moline office, is now with the Detroit office. C. B. HERRICK, of the Philadelphia office, has been given leave of absence to assist the Jefferson Boat Works, Jeffersonville, Ind., with welding problems.

WILLIAM T. STREICHER has been placed in charge of bronze bearing service in the state of Michigan for the Bunting Brass & Bronze Co., Toledo, Ohio. Formerly, Mr. Streicher was in charge of the company's sales and service in Chicago, Ill., where his place will be taken by MARTIN R. HOWE, who, in turn, has represented the company in the New England territory. Mr. Howe will also cover St. Louis and southern Wisconsin.

GEORGE R. ATKINS has been appointed manager of the branch sales office and factory in Akron, Ohio, of the Bristol Co., Waterbury, Conn., manufacturer of automatic control and recording instruments. His headquarters will be at 727 Grant St., Akron. Mr. Atkins has been connected with the company since 1929, and just previous to receiving his present appointment, was with the Pittsburgh office.

WILLIAM F. WISE, executive vice-president of the Aviation Corporation of Detroit, Mich., and president of the American Propeller Corporation of Toledo, Ohio, has been added to the directorate of the National Tool Co., Cleveland, Ohio. EDWARD G. HARDIG has been appointed sales manager of the company. Mr. Hardig has been the sales representative of the National Tool Co. in the Detroit district for the last eleven years.

ARTHUR E. SCHNELL, general superintendent of Aluminum Industries, Inc., Cincinnati, Ohio, has been honored with a United States Army Citation for important savings in vital war material. As a result of a new method developed by Mr. Schnell, a 20 per cent saving in alloy steel has been achieved in producing armor-piercing shot.

A. L. Patrick, Who Retires as President of Cleveland Automatic Machine Co.

James Hammond, New President of Cleveland Automatic Machine Co.

G. V. Patrick, Executive Vice-president of Cleveland Automatic Machine Co.

A. L. Patrick, president of the Cleveland Automatic Machine Co., Cleveland, Ohio, has retired from that position, and Colonel James Hammond, formerly chairman of the board, has been elected president and treasurer by the board of directors. Mr. Patrick will continue to serve the company as chairman of the board. G. V. Patrick, vice-president, has become executive vice-president. The retiring president gave as his reason for retirement at the age of seventy-one a desire to see the active management in younger hands. Previous to his association with the Cleveland Automatic Machine Co., he was connected with the Dean Electric Co. and the General Industries Co., of Elyria.

Colonel Hammond became associated with the company as a stockholder, director, and treasurer in 1941. His previous experience had been in the fields of banking, merchandise, and newspaper publishing. G. V. Patrick joined the company fifteen years ago as eastern sales manager. He left the company for awhile to hold a post in the N.R.A. in Washington, later returning to Cleveland as vice-president in charge of sales. He is a graduate of the Massachusetts Institute of Technology. Millar Brainard, of Otis & Co., was made a director at the meeting of the board, replacing A. B. Taylor, of Elyria. C. Blake McDowell, of Akron, Ohio—a director—was elected secretary, and Ralph Tyler, . of Cleveland, assistant secretary.

Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, has recently received the second renewal of the Army-Navy "E" production award for outstanding war production. The company now flys a pennant with two stars affixed to it, each star representing a renewal of the award for a six months' period.

D. W. Champlin, vice-president and general manager of the Defiance Machine Works, Inc., Defiance Ohio (a Toledo Scale Co. subsidiary), was recently elected a director of the company. At the same time, Orville Noffsinger was elected a director and vice-president.

R. B. Nuckols has been appointed sales manager of the Standard Tool Co., Cleveland, Ohio. He served the company for twenty-four years as salesman, with headquarters in St. Louis, and recently has held the position of assistant sales manager.

Bernard F. Nemerguth has been appointed service manager of the Tocco electrical induction heating and hardening equipment division of the Ohio Crankshaft Co., Cleveland, Ohio. He was formerly chief test engineer of the company.

Oregon and California

Leslie Viar, a machinist with the Willamette Hyster Co., Portland, Ore., was recently presented with the Safety Ace Award for his contributions to the nation-wide safety campaign inaugurated by the National Safety Council to "save man-power for war-power." The award consisted of a $100 War Bond.

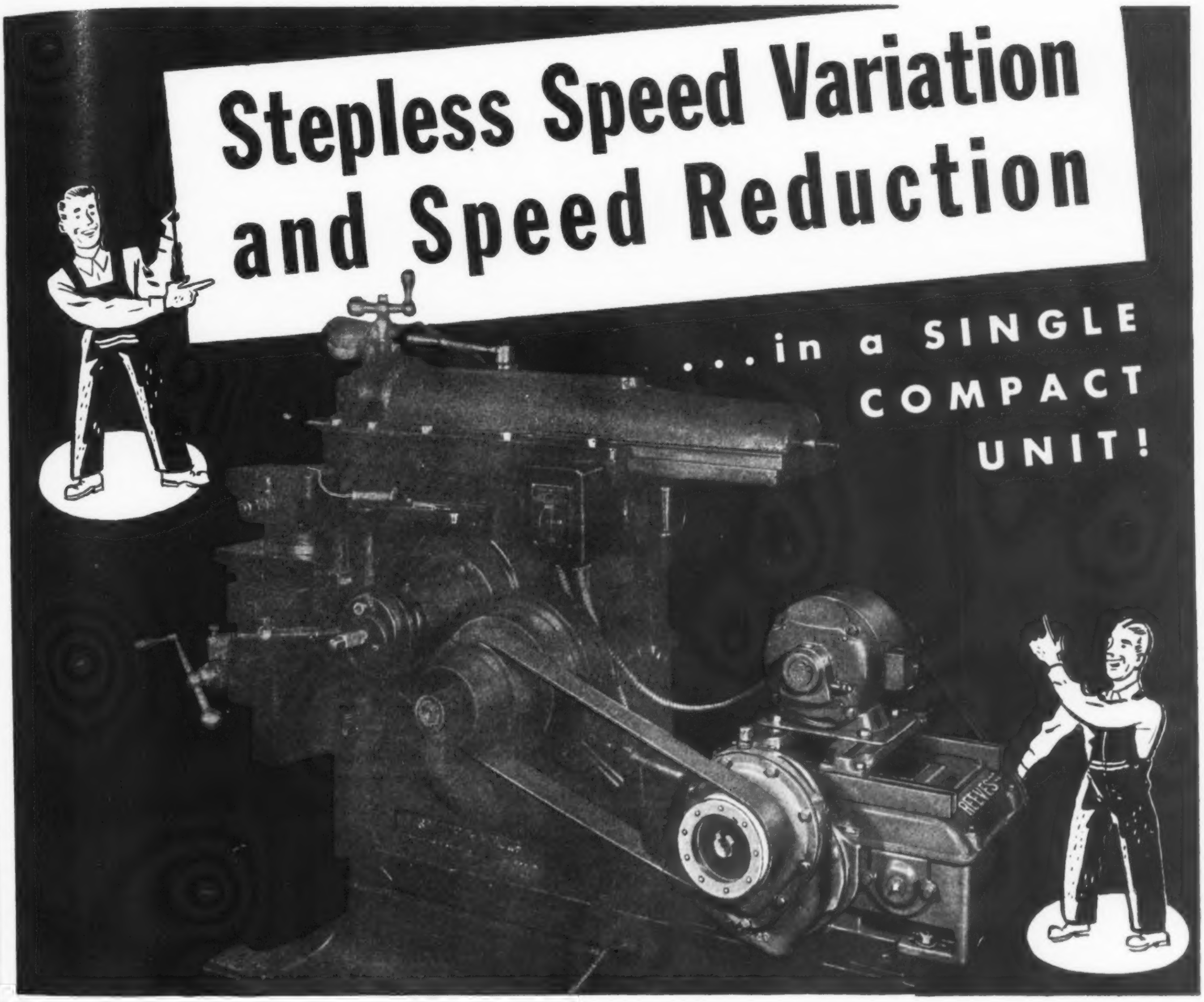
H. M. Harper Co., Chicago, Ill., announces that it has opened a factory branch in the I. N. Van Nuys Bldg., 210 W. 7th St., Los Angeles, Calif., in order to give better service to the Pacific Coast users of "Everlasting" fastenings. Clarence A. Gauger has been placed in charge of the new California branch.

Pennsylvania

Roy M. Smith, who joined the Roller-Smith Co., Bethlehem, Pa., last August as assistant chief engineer, has been appointed chief engineer, succeeding J. D. Wood, who recently resigned. Mr. Smith was formerly engineering manager for the wiring device division of the Bryant Electric Co., and prior to that, was section engineer on relay design and application with the Westinghouse Electric & Mfg. Co.

Robert E. Kulp has been appointed director of research for the Jessop Steel Co., Washington, Pa. He was formerly research metallurgist with the Steel and Tube Division of the Timken Roller Bearing Co., and previous to that was connected with the Lukens Steel Co. in the same capacity.

Robert E. Kulp, Director of Research for the Jessop Steel Co.



Pictured here is a REEVES Reducer-Type Transmission, horizontal design, with individual motor drive, applied to a shaper.

With this new REEVES drive, which consists of the famous REEVES Variable Speed Transmission and built-in, helical-type speed reducer, operator of any production machine has a wide range of low driving speeds instantly available in a single compact unit.

The entire range is covered without steps or jumps. Any required speed for best production under each changing condition is accurately obtained by turning a handwheel, without stopping driven machine or interrupting production.

It's easy to equip the REEVES Reducer-Type Transmission for individual motor drive by means of REEVES adjustable motor base, which will accommodate any available motor. Send for complete information. Use handy coupon below.

Vertical design is especially adapted for use where floor space is limited.

REEVES *Accurate-Variable* SPEED CONTROL

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Send copy of 16-page Catalog MTR-432 giving complete engineering information on the new REEVES Reducer-Type Transmission.

NAME OF FIRM..

INDIVIDUAL....................................ADDRESS..........................

CITY...STATE..........................

EMIL T. JOHNSON, formerly works manager of the Lycoming Division of the Aviation Corporation, Williamsport, Pa., has been promoted to the position of plant manager. He has been with the company since October, 1941, and has served successively as master mechanic, plant superintendent, and works manager. Mr. Johnson was previously connected with the Buda Co., Harvey, Ill., in the capacity of master mechanic and division superintendent in charge of radial engines. He will be succeeded as works manager of the Lycoming Division by HERBERT J. GLASBY.

WILLIAM L. BATT, vice-chairman of the War Production Board and president of SKF Industries, Inc., Philadelphia, Pa., has been awarded the Bok Award for his service to the nation in connection with the industrial mobilization for war production and as a citizen who performed the most distinguished service for Philadelphia in 1942. The recognition consists of a medal and an award of $10,000.

C. O. HEDNER, manager of the hoisting equipment section of the Yale & Towne Mfg. Co., Philadelphia, Pa., was elected chairman of the Electric Hoist Manufacturers Association at a recent meeting of the Association in New York City. SYDNEY BUCKLEY, president and general manager of the Shepard Niles Crane & Hoist Corporation, Montour Falls, N. Y., was elected vice-chairman.

S K F INDUSTRIES, INC., Philadelphia, Pa., manufacturers of ball and roller bearings, announce the following executive promotions: THOMAS W. DINLOCKER has been elected vice-president and treasurer; RICHARD H. DEMOTT, vice-president in charge of sales; and C. P. COLLINS, secretary.

JOHN A. ELMES has been appointed plant manager of the Jones Engineering Co., Ellwood City, Pa., manufacturer of abrasive-belt grinding equipment. Mr. Elmes was formerly chief engineer of the Keystone Driller Co., Beaver Falls, Pa.

Texas

R. H. KNIPPING has recently become a member of the firm of the Power Specialty Co., Houston, Tex. Mr. Knipping will take over the San Antonio, Austin, and Corpus Christi territory which he covered some years ago. The Power Specialty Co. acts as agent for a number of engineering concerns.

DAVE L. RILEY, for the last seven years connected with Greenlee Bros. & Co., of Rockford, Ill., has become associated with the Hughes Tool Co., Houston, Tex., in the capacity of technical advisor.

Wisconsin and Minnesota

FRANCIS J. TRECKER has been appointed secretary of the Kearney & Trecker Corporation, Milwaukee, Wis. Mr. Trecker is the son of Theodore Trecker, Sr., who, together with E. J. Kearney, founded the business in 1898.

Francis J. Trecker, Recently Appointed Secretary of Kearney & Trecker Corporation.

The young Mr. Trecker graduated from Cornell University in 1935 with B. S. degrees in both administrative and mechanical engineering. After graduation, he was associated for several years with the Pratt & Whitney Co. In 1939, he became sales engineer with the Kearney & Trecker Corporation, and the next year, as national defense plans were undertaken, he was placed at the head of the corporation's huge sub-contracting program. Later, he and his brother, Joseph Trecker, were called to Washington as consultants to the War Department's sub-contracting service. When it was decided to build the defense plant addition to the Kearney & Trecker plants in Milwaukee in February, 1942, the administration of plans was given to Francis Trecker.

DUMORE CO., Racine, Wis., manufacturer of fractional-horsepower aircraft motors and precision grinding tools, recently celebrated the thirtieth anniversary of the founding of the company. On account of the urgent need for keeping up war production, no time was taken from regular working hours to celebrate the event. Instead, birthday cakes were distributed to the employes to eat with their lunch, and an especially prepared souvenir booklet was given out.

JAMES TATE has joined the Dumore Co., of Racine, Wis., manufacturer of fractional-horsepower motors, precision tools, and grinders, in the capacity of director of industrial marketing and research. He will be responsible for planning the marketing and manufacturing program of the company for the post-war era.

R. X. RAYMOND, gear sales engineer with the D. O. James Mfg. Co., Chicago, Ill., for the last fifteen years, is now in charge of the company's Minneapolis offices. Mr. Raymond's headquarters will be in the Fawkes Bldg., 1645 Hennepin Ave., Minneapolis, Minn. Mr. Raymond has also been appointed direct representative of the REEVES PULLEY Co., Columbus, Ind.

West Virginia

JOHN ROSEVEAR has recently been appointed manager of the new Fairmont, W. Va., Works of the Westinghouse Lamp Division, Bloomfield, N. J.

* * *

Not a Day Missed in Nineteen Years!

An outstanding attendance record is that made by Herman Rohde, shop foreman at the Westinghouse Lamp Division, Bloomfield, N. J. In his nineteen years with the company, he has never missed a day, and has been late just once—because of a blizzard. Mr. Rohde, who lives about eight miles from the plant, says that he has been able to maintain his record by starting sufficiently early in the morning. "I figure the boys in the Army and Navy get up early, so why shouldn't I?"

Herman Rohde, who has Not Missed a Day of Work in Nineteen Years

WAR-TIME SHOP RECIPES *for thread production*

RECIPES — 140 pages of them — to help you get more accurate threads in production — with better taps, thread gages, thread milling cutters.

If your shop is producing threaded parts, you too should have one of these Shop Recipe books: the new "DETROIT" loose-leaf Catalog No. 22.

Write on your company letterhead.

DETROIT TAP & TOOL CO.

8432 BUTLER STREET, DETROIT, MICHIGAN, U. S. A.

Obituaries

Max W. Babb

Max W. Babb, chairman of the board of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., died on March 13 in Milwaukee, after an illness of several weeks, at the age of sixty-eight years. He joined the Allis-Chalmers organization in 1904 as the company's attorney, having practiced law in Iowa after receiving his degree from the University of Michigan in 1897. He obtained his Bachelor of Arts degree at Iowa Wesleyan University.

In 1913, Mr. Babb was made vice-president and general attorney of the company, and was closely associated with the late General Otto H. Falk in the management of the concern, which underwent a tremendous expansion during and after the first World War. When General Falk became chairman of the board in 1932, Mr. Babb succeeded him as president, and ten years later became chairman of the board.

The present war has again brought the Allis-Chalmers organization into a prominent position in the nation's war production effort, and under Mr. Babb's direction, the company expanded existing manufacturing facilities and added several plants to turn out the equipment required by industry and the Government.

In addition to his Allis-Chalmers activities, Mr. Babb had extensive connections elsewhere in the business and financial world. He had been a director of Cutler-Hammer, Inc., since 1938, and a director of the Federal Reserve Bank for the seventh (Chicago) district since 1930. He was a trustee and a member of the executive committee of the Northwestern Mutual Life Insurance Co. Mr. Babb was also active in the Milwaukee Association of Commerce, and was a member of the American Committee of the International Chamber of Commerce. He was a trustee of the Milwaukee-Downer College.

H. F. T. Erben

H. F. T. Erben, former manager of the General Electric Schenectady Works, died in the Ellis Hospital at Schenectady on April 8, at the age of seventy-seven years.

Mr. Erben was born in New York City in 1866. Following his graduation from Stevens Institute of Technology, he entered the employ of the Edison Machine Works in Schenectady, forerunner of the General Electric Co. Later he became designing engineer of General Electric's direct current department, and in 1914, was made engineer of the Schenectady Works. Two years later, he was promoted to the position of assistant works manager. In 1920, he became works manager, and four years later was named assistant to the vice-president attached to the general manufacturing department. He retired in 1928.

Mr. Erben is survived by his widow and a son, H. V. Erben, manager of General Electric's central station department.

Charles A. Schranz

Charles A. Schranz, manager of the machinery department of the R. D. Wood Co., Philadelphia, Pa., died at his home in Wynnewood, Pa., on March 22, after a brief illness, at the age of sixty-eight years. Mr. Schranz joined the R. D. Wood Co. in 1905 as an engineer specializing in the design of gas holders, gas producers, pumping equipment, and hydraulic machinery. He has been manager of the machinery department for the last twenty-five years. He was also a director of the Florence Pipe Foundry & Machine Co., Philadelphia, Pa., and a member of the American Society of Mechanical Engineers. He is survived by his wife, a sister, and a brother.

Charles William Werst, chief inspector of the Baldwin Locomotive Works, died recently in West Palm Beach, Fla., where he had gone to recuperate. He resided at 383 Kirks Lane, Drexel Hill, Pa.

Mr. Werst was born in Auglaize County, Ohio, June 4, 1867, and entered the employ of the Baldwin Locomotive Works in 1898. He served as foreman and superintendent of several shops until 1910, when he left the company to become general superintendent of the Lima Locomotive Works, Inc., at Lima, Ohio, returning to Baldwin in 1915. He was a charter member of the American Society of Mechanical Engineers. In the first World War he headed a group of engineers and mechanics who went to Russia to re-erect Baldwin locomotives. Mr. Werst is survived by his wife and three children.

Harry Herbert De Loss, a director of Handy & Harman, of New York, died on March 28 at Clearwater, Fla. Mr. De Loss joined the Handy & Harman organization in 1900, when the Standard Metal Co. of Chicago, of which he was principal owner, was absorbed by that company. At that time he moved to Bridgeport, Conn., where he had charge of the company's John St. plant, and was responsible for the original development of the silver and gold refining and manufacturing activities of the concern. The present plant at Bridgeport was built under his direction. Mr. De Loss served in the capacity of vice-president in charge of manufacturing for many years, and was a director of the company from 1905 until his death.

Coming Events

May 13-15—Seventeenth semi-annual meeting of the Eastern Photo-Elasticity Conference and Symposium on Experimental Stress Analysis in Detroit, Mich., at the Rackham Memorial Building, 100 Farnsworth St., under the auspices of the Chrysler Institute of Engineering, Detroit, Mich. Further information can be obtained by addressing Eastern Photo-Elasticity Conference and Symposium on Experimental Stress Analysis, Chrysler Institute of Engineering, Highland Park, Mich.

May 17-19 — Twenty-seventh annual meeting of the American Gear Manufacturers Association at the Westchester Country Club, Rye, N. Y. Newbold C. Goin, manager-secretary, 301-302 Empire Bldg., Pittsburgh, Pa.

May 26-27 — Production Conference of the National Metal Trades Association at the Palmer House, Chicago, Ill. Homer D. Sayre, commissioner, 122 S. Michigan Ave., Chicago, Ill.

June 2-3—Diesel Engine and Fuels and Lubricants Meeting of the Society of Automotive Engineers at the Hotel Carter, Cleveland, Ohio. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

June 9-10—War Materiel Meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

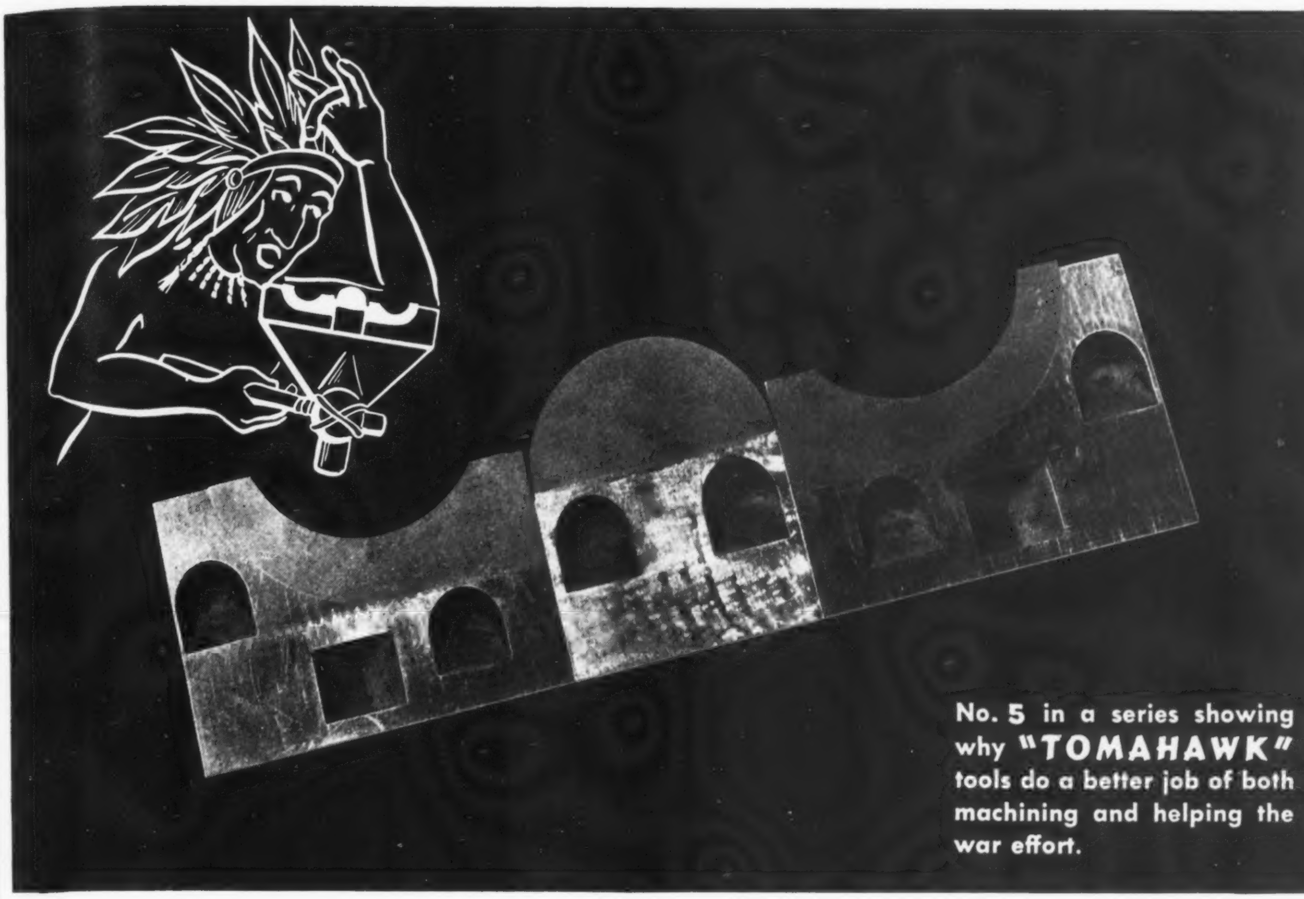
June 14-16—Semi-annual meeting of the American Society of Mechanical Engineers in Los Angeles, Calif. C. E. Davies, secretary, 29 W. 39th St., New York City.

September 30 - October 2 — Aircraft Engineering and Production Meeting of the Society of Automotive Engineers at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

* * *

Management Course

The College of Engineering of the University of Iowa, Iowa City, Iowa, has announced a three weeks' summer management course on production planning, plant lay-out, motion and time study, wage incentives, and related subjects, to be held from June 7 to June 25. Further information can be obtained from Prof. Ralph M. Barnes of the College of Engineering.



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